UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

DEPARTMENT OF CHEMICAL ENGINEERING

DISSERTATION

The South African coal mining industry as a driver of green growth and a low carbon economy? A study on Sustainable Development Goals 7 & 13

Author:
Corey Beavon

A thesis submitted in partial fulfilment of the requirements for the degree of Master of Philosophy
Faculty of Engineering and the Built Environment in the Department of Chemical Engineering

Abstract

There is an apparent inconsistency between South Africa's pledge to transition toward a green economy and its continued dependence on coal-based energy. This research investigates the South African coal mining sector and its alignment with two of the United Nations Sustainable Development Goals (SDGs), in terms of company reporting and measurement of specific indicators. The research methodology employs a content analysis of the 2016 annual reports of the five largest coal companies operating in South Africa. Data is analysed in accordance with the Sustainable Development Goals, to determine if the mining companies are in fact reporting on the specific indicators outlined in the SDGs, and what their strategy is with regard to energy and climate change. The coal sector is analysed in view of South Africa's high contribution to greenhouse gas emissions as a result of its coal-based energy system. Results show that the major coal mining companies are reporting on some of the SDG 7 (Clean Energy) and 13 (Climate Action) indicators. The quality of the data varies, however, and the lack of uniformity in reporting makes comparison between firms challenging. Some companies have created sophisticated climate action plans, with one company showing strategic intent to diversify its core business into renewable energy production, while three others are implementing some form of renewable energy deployment onsite. There are thus definite signs of active engagement with the specific SDGs, but not (yet) of radical innovation. In conclusion it has been found that coal companies operating in the South African coal sector do have the sufficient systems in place to measure and report on data that is critical for reaching Sustainable Development Goal 7 (Clean Energy) and Sustainable Development Goal 13 (Climate Action), however it cannot be stated that by early 2017, the companies were representing demonstrable progress in contributing toward meeting these targets. It can also be concluded that publicly released data can be used to gauge a company's sustainability performance, however doing a comparative analysis remains challenging and there are no industry standards to define what are acceptable emissions or energy use across different industries.

Plagiarism Declaration:

This thesis/dissertation has been submitted to the Turnitin module (or equivalent similarity and originality checking software) and I confirm that my supervisor has seen my report and any concerns revealed by such have been resolved with my supervisor.
Student: Corey Beavon
Sign:

Signed by candidate

Acknowledgements

I would like to thank my supervisors Prof Harro von Blottnitz of the Department of Chemical Engineering and my co-supervisor Dr Brett Cohen of the Green House Consultancy. Special thanks goes to Professor Dee Bradshaw who has been a guiding figure through-out the writing of this dissertation. Finally, thanks must go to Associate Professor Jennifer Broadhurst and the rest of the team at Minerals to Metals. The programme provided me with an amazing opportunity to travel and learn about sustainable development in a practical way.

Table of Contents

List of Tables

List of Figures

List of Abbreviations and Acronyms

BUSA - Business Unity South Africa
CBIPPP- Coal Baseload Independent Power Producer Procurement Programme
CCS- Carbon Capture and Storage
CO2- Carbon Dioxide
COM - Chamber of Mines in South Africa
COP- Conference of the Parties
COP15- Copenhagen Climate Change Conference
COP21- Paris Climate Change Conference
CSR – Corporate Social Responsibility
DMA- Disclosures on Management Approach
DMR-Department of Mineral Resources
EiRC- Ethics in Research Committee
ESG- Environmental, Social and Governance
FGD- Flue Gas Desulphurisation
GHG- Green House Gas Emissions
GRI- Global Reporting Initiative
GDP- Gross Domestic Product
ICMM- International Council on Mining and Metals
ICS- International Council for Science
IEP – Integrated Energy Plan
IOD-Institute of Directors
IRP- Integrated Resource Plan
IIRC- International Integrated Reporting Council
IPCC- Intergovernmental Panel on Climate Change
IPP- Independent Power Producer Programme
IPAP-Industrial Policy Action Plan
ITTCC - Industry Task Team on Climate Change
ISO- International Organization for Standardization
SDG- Sustainable Development Goals
SR- Sustainability Report
LTMS- Long Term Mitigation Scenario
MDG- Millennium Development Goals
MinCoSA - Minerals Council of South Arica
Mt- Mega tonnes
Mtpa- Mega tonnes per annum
NDP – New Development Plan
NGP – New Growth Path
NPC – Non-profit company
REIPPP - Renewable Energy Independent Power Producer Procurement Programme
RE- Renewable Energy
SRI – Social Responsibility Index
OECD- Organization for Economic Cooperation and Development

UN- United Nations
UNGC- United Nations Global Compact
UNFCCC- United Nations Framework Convention on Climate Change
UNEP- United Nations Environment Programme

1. Introduction

In September 2015, the majority of the world's nations (193) agreed to adopt the UN Sustainable Development Goals for 2015-2030. The 17 SDGs contain 169 targets that impose specific features, which are to be monitored to gauge progress towards meeting the goals. South Africa has pledged to transition toward a greener economy in a bid to meet these targets, however the country is locked into a coal based energy system. Therefore, this dissertation investigates mining companies operating in the South African coal sector from the perspective of two of the Sustainable Development Goals (SDG), namely clean energy and climate action.

This chapter provides a brief introduction into the sustainable development goals, highlights the importance of the coal sector toward the South African economy, and concludes with the problem statement and objectives of this dissertation.

1.1. Background

1.1.1. Sustainable Development Goals

In September 2015 Heads of State and Government agreed to set the world on a path towards Sustainable Development through the adoption of the 2030 Agenda for Sustainable Development. This agenda includes 17 Sustainable Development Goals (SDGs) which set out quantitative objectives across the social, economic, and environmental dimensions of sustainable development – all to be achieved by 2030.

The SDGs are designed to be an integrated and indivisible set of aims which provide a global framework for development that encompasses economic, environmental and social aspects of sustainability. Although the interlinked and integrated nature of the SDGs is acknowledged, the specific interactions and interdependencies between them are not explicit in the description of the goals and their associated targets. For the true potential of the SDGs to be unlocked it is therefore important to understand the interactions between the particular SDGs in relation to specific industries. In some instances these interdependencies may be synergistic or counterproductive. For example, achieving SDG 2 (Zero Hunger) may result in natural ecosystems being cleared for agriculture, thereby reducing SDG 15 (Life of land). These potential synergies or trade-offs are important to understand, as specific regions or industries may prioritise some goals over others, depending on their needs.

1.1.2. Context to Sustainable Development Goal 7, Clean Energy, and 13 Climate Action

The South African economy was traditionally built on the mining industry. Abundant coal reserves provided cheap energy to the mining houses and railways to allow for rapid industrialisation. South Africa's growth trajectory was fuelled by a cheap and abundant supply of coal, and it is still locked into this coal-based energy system. Yet, this industrialisation was not an inclusive one and in the Apartheid state, a large proportion of the population was systematically excluded from modern energy access. The coal industry supplies South Africa with over 90% of its total electricity production and around 30% of its liquid fuels (Burton & Winkler, 2014), while remaining the largest revenue generator of all South African commodities (PWC, 2016).This dependence means South Africa's per capita CO2 emissions are inordinately high considering its level of development (Death, 2014). Despite this, South Africa is a significant player in the global green economy sector, having made international commitments to reduce its carbon emissions, and releasing climate change legislation that includes introduction of a carbon tax and starting a renewable energy programme. South Africa has pledged to reduce national emissions at the 2009 Copenhagen COP15 conference, has been a signatory of the United Nations Framework Convention on Climate Change, and in 2014 South Africa was placed in the top 10 countries for renewable energy (RE) investment by UNEP. It has set up a globally acknowledged renewable energy procurement programme, the Renewable Energy Independent Power Producer Procurement Programme (REIPPP), which is South Africa's first procurement programme, which allows private companies to produce energy and sell it to Eskom. Therefore defining the intersection of the coal mining industry and South Africa's policy on climate action through methodology provided by SDGs proposes an intriguing case study.

1.2. Problem Statement

The social and environmental issues of mining are particularly significant in South Africa, where mining has dominated the economy for so long and played a role in the country has blighted history. South Africa is also an inordinate polluter of GHGs, with higher GHG emission intensity than China (Raubenheimer, 2015), due to its coal based energy system and yet it has committed itself in 2015 to meeting the UN's SDGs and in 2016 it ratified the Paris Accord. Therefore, it is of relevance to see if the national strategy and priority on climate action and energy is being addressed in the coal sector. In particular, the South African coal sector's position and strategy towards clean energy and climate action has not been investigated through the lens of the UN SDGs. It is thus not known to which extent they are being adopted in the South African coal mining sector.

1.3. Dissertation Objectives and Approach

The advent of the SDGs has introduced new requirements to sustainability reporting. This paper therefore aims to provide insight as to whether companies are reporting on these indicators, and have developed a strategy for meeting the desired outcomes. Given the background, the objectives of the dissertation are therefore as follows:

1. To provide a practical methodology with which to analyse sustainability reporting in an industrial sector through the lens of the SDGs.
2. To provide insights into the strategies of companies with significant coal assets and determine whether they are making demonstrable progress in contributing toward meeting those Sustainable Development Goals that are material for the sector.

In order to pursue these objectives this dissertation presents a qualitative content analysis of reporting by the major coal producers operating in South Africa. The qualitative analysis is designed through a literature review of current sustainability-reporting mechanisms together with the framework outlined by the SDGs. An indicator list is developed from relevant literature. The indicator list will be compared with current reporting guidelines and a scoring system is developed in order to evaluate the performance of each company. This will allow for the analysis of the quality of reporting, and allow insights to be drawn on their score. This provides an indication as to how aligned current reporting mechanisms are to the SDGs, and the strategic position that companies in the coal industry have toward clean energy and climate action.

1.4. Scope and Limitation

The study is limited by the fact that only secondary data is utilised in the analysis; this being information that is publicly available through companies' annually published reports and supplemental online information. The author does not have a means by which to validate specific information found within each report, and therefore the validity of the data employed in the analysis is entrusted to each respective company.

It should be highlighted that if a company submits high quality sustainability reports it does not necessarily guarantee that the company is operating sustainably. An analysis of the presence and quality of the data can therefore highlight areas where policies, procedures and systems are either non-existent or poorly designed in the management of sustainability risks. As such, the study aims not to assess the quality of what a company says it is, but rather to assess whether publicly-available data can prove that the company is achieving demonstrable progress towards meeting the SDGs.

The analysis is confined to companies operating within the South African coal sector. A further challenge was experienced in collecting data from mining operations not under sole control or ownership of a single company.

1.5. Dissertation Structure

The dissertation begins with a literature review of sustainability reporting and the UN's SDGs. This review forms the basis of the methodology of the analysis conducted. The literature review continues with an analysis of the South African coal industry and the South African government's commitment to a green economy. This provides the context required to understand the strategic position the coal industry has in the ability of South Africa to reach its development goals with regard to clean energy and climate change.

The literature review is followed by a research methodology chapter, where the author introduces the framework for the analysis. The SDGs are explained in relation to the South African coal sector. The development of the indicator list and scoring system is then outlined. Following this, the findings are provided in a discussion on each of the five companies evaluated. In addition, a reflection on the strategic position companies have towards clean energy and climate action are explained, together with insights on sustainability-focused innovations within certain companies. Penultimately, the dissertation presents its conclusions and sets up further research topics; and, finally, a detailed bibliography is given.

2. Literature Review

2.1. Sustainable Development Goals

The most commonly-referred-to definition of Sustainable development is given in the Brundtland Report (1987) as: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The concept of Sustainable Development has been operationalised through various international conferences, policies and documents. In the last twenty years, key global conferences involving the implementation of Sustainable Development have included: the 1992 Rio Earth Summit, the Millennium Summit and the Millennium Development Goals (MDGs) of 2000, the 2005 World Summit, the 2010 MDG Summit, the lead-up to the Rio+20 Conference in 2012 and the release of the UN's SDGs in 2015. The idea of global goals accompanied by concrete indicators was originally proposed by the governments of Colombia and Guatemala, and officially introduced at the Rio+20 Conference in 2012. SDGs are a universal set of goals, targets and indicators that UN member states use to frame agendas and policies over the next 15 years. SDGs follow, and expand on, the Millennium Development Goals (MDGs) formulated by governments in 2000, and which expired at the end of 2015 (Evans and Steven, 2012).

In September 2015 Heads of State and Government agreed to set the world on a path towards Sustainable Development through the adoption of the 2030 Agenda for Sustainable Development. This agenda includes 17 Sustainable Development Goals (SDGs) which set out quantitative objectives across the social, economic, and environmental dimensions of sustainable development – all to be achieved by 2030. The goals provide a framework for shared action "for people, planet and prosperity", to be implemented by "all countries and all stakeholders, acting in collaborative partnership". As articulated in the 2030 Agenda, "never before have world leaders pledged common action and endeavour across such a broad and universal policy agenda". 169 targets accompany the 17 goals, and set out quantitative and qualitative objectives for the next 15 years. These targets are "global in nature and universally applicable, taking into account different national realities, capacities and levels of development and respecting national policies and priorities". A set of indicators and a monitoring framework also accompany the goals. The indicators are defined by the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs). Effective SDGs, targets, and their indicators will serve as a management tool to help countries develop implementation strategies and allocate resources accordingly. They will also serve as a report card to measure progress towards Sustainable Development, and to help ensure the accountability of all stakeholders for achieving the SDGs. Indicators will be the backbone of monitoring progress towards the SDGs at local, national, regional, and global levels (Review of Targets for the Sustainable Development Goals: The Science Perspective. 2015).

The SDGs represent a paradigm shift in global sustainability thinking. They recognise the complex interactions between social, economic and environmental dimensions of sustainability. The recognition of this interconnectivity has resulted in strong themes of universality, integration and transformation within the SDGs. The SDGs form a connected web, so that the agenda cannot be advanced in isolation; for this reason the goals are aimed to be implemented in every country and all sectors including cities, businesses, schools and organisations. The interconnected nature of the SDGs will require a shift away from compartmentalised policy design, and will also require an unprecedented level of collaboration and dialogue between different stakeholders to ensure that

goals are properly employed. The SDGs have placed significant emphasis on business to help achieve many of the goals:

- through direct investments;
- developing new technologies for energy, health and other SDG priorities; and
- aligning business incentives and behaviour with the social objectives of Sustainable Development.

For this reason it is critical that business metrics be closely aligned with SDGs and the underlying indicator framework. The SDGs form an integrated system, many goals being directly and indirectly linked to others. This coupled nature of the goals means that all goals must be achieved if the SDGs are proved to be a success. Mapping which goals apply more directly to each sector is an important first step in the implementation of the SDGs, however. Figure 1 below indicates which goals may have the greatest significance to the mining sector, while Table 1 on the following page provides the target attached to each Sustainable Development Goal.

Figure 1: SDGs encircled in blue dashed line are high-potential areas for the mining industry. (Mapping mining to the Sustainable Development Goals: An atlas, 2016)

SDGs can be divided broadly into three categories (Kumar & Vivekadhish, 2016):

- First, an extension of MDGs that includes the first seven SDGs;
- Second, inclusiveness (jobs, infrastructure, industrialisation, distribution), and embracing goals 8, 9, and 10;
- Third, sustainability and urbanisation that covers the final seven goals:
    - sustainable cities and communities,
    - life below water consumption and production;
    - climate action;
    - resources and environment;
    - peace and justice;

- the means of implementation and global partnership for it.

Table 1: SDG name and target

SDG	SDG name	SDG target
1	End Poverty	End poverty in all forms everywhere.
5	Gender Equality	Achieve gender equality, empowering women and girls.
6	Clean Water and Sanitation	Ensure availability and sustainable management of water and sanitation.
7	Renewable Energy	Ensure access to affordable, reliable, sustainable and modern energy for all.
8	Good Jobs and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all.
9	Innovation and Infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialisation, and foster innovation.
10	Reduced Inequalities	Reduce inequality within and among countries.
13	Climate Action	Take urgent action to combat climate change and impacts.
15	Life on Land	Protect, restore and promote sustainable use of terrestrial ecosystems, manage forests sustainably, manage desertification, halt and reverse land degradation, and halt biodiversity loss.
16	Peace, Justice and Strong Institutions	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable and inclusive institutions at all levels.
17	Partnerships for the Goals	Strengthen the means of implementation and revitalise global partnership for Sustainable Development.

Each of the Sustainable Development targets are made up further sub-targets. The sub-targets for SDG 7 and 13 are depicted in the tables below

Table 2: Targets for SDG 7

7.1	By 2030, ensure universal access to affordable, reliable and modern energy services
7.2	By 2030, increase substantially the share of renewable energy in the global energy mix
7.3	By 2030, double the global rate of improvement in energy efficiency
7.A	By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology
7.B	By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support

Table 3: Targets for SDG 13

13.1	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.
13.2	Integrate climate change measures into national policies, strategies and planning
13.3	Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
13.A	Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible
13.B	Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities

2.1.1. Millennium Development Goals

MDGs are the result of a process that started in 1990, which aimed at making aid more effective, and focusing it more on poverty reduction. In addition, it started taking "poverty" as a multi-dimensional phenomenon rather than simply a lack of income (Loewe, 2012). The strength of MDGs is that they constitute a manageable number of straightforward goals which were easy to understand and measure, with a clear deadline.

The MDG experience provides compelling evidence that the international community can be mobilised into confronting such complex challenges. Governments, civil society, and a wide range of international actors supported the MDGs in a multi-front battle against poverty and disease. They generated innovative approaches, vital new data, new resources, and new tools and technology for this struggle. Transparency was enhanced, multilateral approaches were strengthened, and a results-based approach to public policy was fostered. Sound public policies inspired by the MDGs, enhanced by collective action and international cooperation, led to remarkable successes. In the two decades following 1990, the world halved extreme poverty, lifting 700 million out of it. Between 2000 and 2010, an estimated 3.3 million deaths from malaria were averted, and 22 million lives were saved in the fight against tuberculosis. Access to antiretroviral therapy (ART) for HIV-infected people has saved 6.6 million lives since 1995. At the same time, gender parity in primary school enrolment, access to child and maternal health care, and women's political participation improved steadily (The Millennium Development Goals Report, 2014).

There have been great improvements in data-gathering under the MDGs, yet the goals have not served as either a management tool or a real-time report card. MDG data comes with too great a time lag – often three or more years – and too often the data is incomplete and of poor quality. MDG monitoring has also given too little attention to what should be measured: hence, to date, we lack some important metrics for key development priorities. Similarly, there has been too little investment in strengthening statistical capacity to ensure effective real-time monitoring of the

MDGs and to establish statistical standards and quality requirements (Sustainable Development Solutions Network, 2015).

Table 4: Millennium Development Goals

1.	Eradicate extreme poverty and hunger
2.	Achieve universal primary education
3.	Promote gender equality, empowering women
4.	Reduce child mortality
5.	Improve maternal health
6.	Combat HIV/AIDS, malaria, and other diseases
7.	Ensure environmental sustainability
8.	Develop a global partnership for development

2.1.2. Comparison between MDGs and SDGs

- MDGs were drawn up by a group of experts in the UN headquarters, whereas SDGs have evolved after a long and extensive consultative process including 70 open working groups, civil society organisations, thematic consultations, country consultations, as well as participation of general public through face-to-face meetings and online mechanisms and door to door survey.
- Whereas MDGs were focused with 8 goals, 21 targets and 63 indicators, SDGs include 17 goals and 169 targets.
- MDGs dealt with developing countries only and, to a limited degree, captured all three dimensions of sustainability. By contrast, SDGs deal with all countries and all dimensions, although the relevance of each goal varies from country to country. Nevertheless despite both repetition and many weakly-formulated targets in the open working groups' proposal, the SDG process has been a giant step forward due to the effort of creating universal goals which articulate need and opportunity for the global community to cooperate to create a sustainable future in an inter-connected world.
- The MDGs failed to comment on monitoring, evaluation and accountability – while SDGs aim, by 2020 , to "increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts" (Sustainable Development Solutions Network, 2015).

2.2. Paris Climate Agreement

The Conference of the Parties (COP21) concluded with the Paris Agreement. The Paris Agreement marks a milestone in climate negotiations and, for the first time, establishes a regime to limit global warming to below 2˚C. The negotiated outcomes will influence national policies and energy technology choices for decades into the future. The Paris Agreement represents a commitment to achieve a number of global climate-change goals, including:

- Holding average temperature increase to well below 2°C, and pursuing efforts to keep warming below 1.5°C. To achieve this goal, countries are to have net zero emissions as soon as possible after 2050, by achieving a balance between anthropogenic emissions by sources and emissions absorption or removals by carbon sinks.
- Reviewing implementation and progressive global stock-takes on progress towards delivering outcomes well below the 2°C goal every 5 years from 2020. In 2025, all countries shall submit and communicate revised nationally-determined contributions (NDCs) and mitigation targets.
- Supporting efforts of developing countries to build clean, climate-resilient futures including provision of resources to achieve a balance between adaptation and mitigation. This includes financial, technological and industrial support to help developing countries implement the Agreement. Countries will work to define a clear roadmap for increasing climate investment to US$100 billion per year by 2020.
- Promoting actions that enhance adaptation, and build resilience to the impacts of climate change (The Paris Climate Agreement, 2015).

2.3. Sustainability Reporting

Sustainability Reports have moved from simply demonstrating a company's commitment to the environment, to communicating environmental performance data. In addition, environmental reports demonstrate a company's openness toward stakeholders and the importance of strategic environmental management (Azzone *et al*., 1997).

The earliest stand-alone environmental reports were produced by companies in the petrochemical sector, in the 1980s and early 1990s (eg. Shell Canada produced its "progress toward sustainable development" report in 1991); while the mining sector followed with environmental reports more slowly in the 1990s, gradually gathering momentum (Scott, 2000). It has been noted that companies operating in so-called environmentally-sensitive industries such as mineral extraction, oil and gas, chemicals and forestry, are more likely to provide social and environmental disclosure (Neu, Warsame & Pedwell, 1998).

2.3.1. Annual Reports

Companies present data on their sustainability performance in various ways. The most common and comprehensive way to do this, however, is through the corporate annual report and other sustainability reports (KPMG, 2013). In contrast with most countries, sustainability reporting in South Africa is compulsory for listed companies. Whereas consumer, shareholder and/or other stakeholder requests for additional information drive reporting trends in the more developed economies of Europe and North America, the key motivation for integrated sustainability reporting in the South African context is centred around the listing requirements of the Johannesburg Stock Exchange (JSE) (Rea, 2012).

In this study, the corporate annual report is viewed as a means by which organisations seek to establish an image in the public sphere through voluntary reporting, thereby emphasising the role of the annual report in constructing and presenting a 'reality' of corporate life (Hines, 1989); and seek to promote the interests of an organisation by providing a 'snapshot' of the mindset of corporate management (Gray, Kouhy & Lavers, 1995).

Annual reports of organisations listed on stock exchanges have often become a source of raw data for reporting studies, and have therefore have served as instruments for observing voluntary reporting. Annual reports are used because organisations commonly signal what they perceive as important in this way. While important issues are featured, reported and discussed, less important items are omitted or relegated to low-profile sections of the report (Gibson & Guthrie, 1994).

2.3.2. Sustainability Reports

Sustainability reporting sets goals, measures performance, compiles and reports on the corporation's performance in a way that combines long-term profitability with social and environmental responsibility. It is the main source of communicating the corporation's environmental and social performance, both negative and positive (GRI, 2013).

Sustainability Reports (SRs) provide "information relating to a corporation's activities, aspirations and public image with regard to environmental, community, employee and consumer issues"

(Gray *et al.*, 2001). SRs are intended typically to inform a wide range of stakeholders, from activist groups operating in the community to shareholders and investors, who may be interested in the social performance of the company as a predictor of its financial performance (Daub, 2007). This fundamental characteristic of sustainability reporting is also evident in the framework proposed by the Global Reporting Initiative (GRI), which organises the various elements proposed by stakeholder groups. Given the broadness of the concept of "stakeholder" and, consequently, of the boundaries of the report, an increasing amount of attention has been placed lately on the definition of material issues, which might have an impact on the company's ability to create value in the long-term. Companies need to evaluate, carefully, who the relevant stakeholders are, and which issues they wish to communicate to them.

2.3.3. Integrated Reports

According to the International Integrated Reporting Council (IIRC), an integrated report is a concise communication about how an organisation's strategy, governance, performance and prospects, in the context of its external environment, lead to the creation of value over the short, medium and long term. Integrated reporting combines the most material elements of information, currently presented in separate reporting strands, into a coherent whole, and importantly shows the connectivity between them, explaining how they affect the ability of an organisation to create and sustain value in the short, medium and long term (IIRC, 2011). The key objective of an integrated report is to enhance accountability and stewardship with respect to the broad base of six kinds of capital: financial, manufactured, intellectual, human, social and natural, and to promote understanding of their interdependencies. In doing this, IR is designed to support integrated thinking, decision-making and actions that focus on sustainable value creation for stakeholders (Busco *et al*., 2013).

The King Report on Governance for South Africa (King III) has been steering the focus on integrated reporting in the country. The core principles in King III are that performance, risk strategy and sustainability are inseparable. The GRI announced the formation of the IIRC in August 2010. The responsibility of the IIRC is to create a framework for sustainability accounting that is accepted globally, bringing together financial, social, environmental and governance information in an understandable, consistent, concise and comparable format (KPMG, 2011a). IR is just such a framework. According to KPMG (2011b), the aim is to assist with the development of more comprehensive information about businesses — prospective as well as retrospective — to meet the requirements of a more sustainable, global economy.

For any stakeholder it could be confusing to encounter a company's website, where the options of downloadable reports include an integrated report, annual report, sustainability report and/or a supplementary report. The following table therefore provides a brief summary of the difference between the three reporting formats.

Table 5: Main features of annual, sustainability and integrated reports (Fasan, 2013)

	Annual Reports	Sustainability Reports	Integrated Reports
Target	Shareholders and investors	Several stakeholders (from a social and environmental perspective)	Primarily providers of financial capital
Mandatory/ voluntary	Mandatory	Voluntary (with some exceptions: Denmark, Sweden, France)	Voluntary (with one exception South Africa)
Regulation or guidelines	National and international laws	Global reporting initiative (GRI)	IIRC framework
Comparability	High	Medium	Low
Assurance	High	Low	Low
Scope	Financial reporting entity (company or group of companies)	Broader than financial reporting entity (supply chain, LCA approach)	Broader than financial reporting entity (supply chain, LCA approach)

2.3.4. Corporate Social Responsibility

Corporate Social Responsibility relates to the activities of businesses, particularly in terms of their contribution to achieving economic, social and environmental sustainability (Jenkins & Yakovleva, 2006). CSR calls for a company to respond not only to its shareholders but also to other stakeholders, including employees, customers, affected communities and the general public, on issues such as human rights, employee welfare and climate change. CSR is particularly necessary in South Africa, where there is a vital need for profitable enterprise, emphasis by the government on economic inclusion of the poor, and the constitutional requirement of civic participation and environmental protection (Hamann, Booth & O'Riordan, 2000); and where there is also a strong tradition of local self-help and social networking (O'Riordan *et al*., 2000).

CSR has had a long evolution, and the definition of the concept has shifted over-time. Definitions of CSR began to proliferate in the 1970s and became more specific subsequently. One of the first and most prominent definitions was outlined by Keith Davis (1960); "Business men's decisions and actions taken for reasons at least partially beyond the firms direct economic or technical interest". Davis revisited the definition of CSR in multiple publications. Another classic example that encapsulates CSR: "It means that social responsibility begins where the law ends. A firm is not being socially responsible if it merely complies with the minimum requirements of the law", was given by Davis (1973). The European Commission redefined CSR as "the responsibility of enterprises for their impacts on society" (European Commission, 2011), stating that corporations should take into account social, environmental, ethical and human rights as well as consumer concerns in their strategy. There is, however, no clear-cut definition of CSR, although the focus is on advancing the benefit to society as well as the voluntary aspect of CSR.

It is worth noting that, during the formulation of CSR, there have been debates as to whether or not it is the responsibility of a company to do more than merely make a profit for its shareholders. Friedman (1962) argued that it would undermine the foundations of a free society to expect a company to do more than its core functions. This matter is still debated in schools of economics today. For the purpose of this thesis, we will assume that companies do have a responsibility beyond making profits for their shareholders.

The evolving CSR agenda is driven by a global shift in the way that business is perceived (Hamann, 2003). Within the past 20 years, concerns about the sustainability and social responsibility of industry have become an increasingly high-profile issue in many countries and industries, none more so than in the mining industry. Drivers behind this shift can be identified by the following developments:

- There is a growing emphasis amongst organisations, such as the United Nations and other NGOs, that partnerships are needed with business in order to achieve sustainability objectives. This is shown by the UN's Sustainable Development Goals, and the UNs Global Compact.
- There is an increasing view that CSR represents enlightened self-interest rather than philanthropic activity. Prominent examples include the World Business Council for Sustainable Development, and Business for Social Responsibility.
- A wide range of sustainability reporting guidelines have been established, such as the Global Reporting Initiative (GRI), International Finance Cooperation (IFC) and the Carbon Disclosure Project (CDP).

2.3.5. Global Reporting Initiative

The GRI is a framework that assists firms with their sustainability reporting by providing specific report standards for recording environmental, social and economic performance (Nikolaou *et al*., 2013). According to Knudsen (2006), the GRI was established in 1997 as a joint initiative of the US non-governmental organisation Coalition for Environmentally Responsible Economies (CERES) and United Nations Environment Programme (UNEP). The GRI states that it is was borne out of concern about the lack of reliable sustainability reporting by organisations. The GRI released its G2 revision in 2002, G3 in 2006, G3.1 in 2011; and its current iteration, G4, was released in 2013 (GRI, 2013a).

The G4 guidelines are divided into two main documents: the "Reporting Principles and Standard Disclosure" and the "Implementation Manual". Each company has the opportunity to prepare its guidelines in accordance with either the "Core" option or "Comprehensive" option, the Comprehensive option requiring additional disclosures compared with those of the Core option. This approach is also an attempt to make the GRI G4 accessible to companies reporting their sustainability data for the first time, or to smaller firms.

The two pillars of the GRI framework are reporting principles and elements. The reporting principles defined by G4 are the following: stakeholder inclusiveness, sustainability context, materiality, completeness, balance, comparability, accuracy, timeliness, clarity and reliability. GRI elements (both those required to be disclosed in accordance with the Core option and those to with the Comprehensive option) are divided into the following categories:

- strategy and analysis
- organisational profile
- identified material aspects and boundaries
- stakeholder engagement
- report profile
- governance
- ethics and integrity.

The G4 provides companies with the opportunity to disclose how they manage some particular aspects of their environmental, social or governance performance, through its Disclosures on Management Approach (DMA). The DMA provides narrative information on how an organisation can identify, analyse and respond to its actual and potential material, economic, environmental and social impacts. DMA is ultimately the way GRI balances standardisation and customisation.

The explicit aim of the GRI was to harmonise and to clarify the practice of non-financial reporting. The process of developing the guidelines was intended to institutionalise a discussion among a wide range of stakeholders, set up new standards and practices, and facilitate the emergence of novel understandings of corporate accountability (Levy & Brown, 2011). The GRI aimed to transform the corporate accounting process by integrating Environmental, Social and Governance (ESG) data with conventional financial data, thus making sustainability reporting as routine as traditional financial auditing (Perez, 2006). Considering the above, the GRI has undoubtedly contributed to the legitimacy and establishment of CSR as a practice, has presented a common language and set of procedures in the field, and has contributed to solidifying sustainability reporting as a standard business practice.

2.3.5.1. Application levels of the Framework

Application levels indicate the degree to which the reporting company has applied the guidelines in its sustainability report by communicating which set of disclosures have been addressed. They do not give an opinion on the organisation‘s sustainability performance, but rather aim to reflect the extent of transparency in reporting against the GRI Guidelines by confirming the amount of Reporting Guidelines content that has been addressed. There are three separate application levels: A, B and C. A indicates the highest level of compliance and adherence to the Framework; B is the midway level; and C is the lowest level of adherence (GRI, 2011c). According to GRI (2011c), reporting companies are required to assess their own application level. GRI offers a service for organisations to either have their self-declared application level-checked and confirmed; or they can choose to have their application level checked by a third party not affiliated with GRI. GRI uses the term “external assurance” in referring to activities designed to result in published conclusions on the quality of the report and the information contained therein. When a reporting organisation has submitted its sustainability report for external assurance, a “+” sign can be added to an application level, to infer a higher quality report.

2.3.6. The International Integrated Reporting Council

The IIRC was established formally in August 2010. At its inception, the IIRC’s most remarkable feature was the extraordinarily high-powered character of its governing body. Among its 40 members were heads of The International Accounting Standards Board (IASB), The Financial Accounting Standards Board (FASB), The International Federation of Accountants and The International Organisation of Securities Commissions (IOSC), the CEOs of Deloitte, Ernst & Young, KPMG and PWC, heads of the major British professional accountancy bodies, and CFOs of major multi-internationals, such as Nestlé, Tata and HSBC. The Council was dominated by the accountancy profession who comprised more than half of its members (Flower, 2014).

The leading country in the world on IR is South Africa, where 93% of the 100 largest companies issued integrated reports (KPMG, 2013). IR is driven by the King Report on Corporate Governance 2010 (King III), a non-legislated code on good corporate governance that requires integrated

sustainability reporting. However, while not mandatory legislation it is a requirement for listing on the Johannesburg Stock Exchange (UNEP *et al*., 2013). In 2014, the Integrated Reporting Committee of South Africa endorsed the IIRC's Integrated Reporting Framework, urging South African companies to start implementing the IIRC framework into their IRs (IIRC, 2014).

2.3.7. UN Global Compact (UNGC)

The UNGC provides a principle-based framework, best practices and resources for companies to do business more sustainably. With the support of business and other stakeholders, the UNGCs governance framework was adopted by then UN Secretary-General Kofi Annan, on 12 August 2005. The resulting governance framework distributes functions among several entities so as to engage participants and stakeholders, at global and local levels, in making decisions and giving advice on matters of greatest importance to their role and participation in the UNGC, and to reflect the initiative's public-private and multi-stakeholder character. With more than 12 000 corporations and organisations from over 145 countries, the UNGC is the largest voluntary corporate-responsibility initiative in the world (UN Global Compact, 2015).

The UNGC aims to mobilise companies to operate more sustainably by aligning their strategies and operations with principles on human rights, labour, environment and anti-corruption; and, further, to take strategic action in advancing broader societal goals such as the UN Sustainable Development Goals, with an emphasis on collaboration and innovation (UNGC, 2018).

2.3.8. OECD Guidelines for Multinational Enterprises

The Organisation for Economic Cooperation and Development (OECD) developed its guidelines in 1976 and has updated them five times, most recently in 2011. Governments from 44 countries, both non-OECD and OECD, adhere to these guidelines and encourage their enterprises to observe them wherever they operate. The guidelines are a set of recommendations for responsible business conduct, covering topics such as information disclosure, human rights, employment and labour, environment, anti-corruption, competition, science and technology, taxation, and consumer interest. Although the guidelines are voluntary, international or national law regulates some issues that covered. In addition, these guidelines are the definitive multinational code of conduct for responsible business (OECD, 2014).

2.3.9. Carbon Disclosure Project

The CDP is an international, UK-based, non-profit organisation providing a global system for companies (and cities) to measure, disclose, manage and share vital environmental information. In 2008, the CDP published the emissions data for 1 550 of the world's largest corporations, accounting for 26% of global anthropogenic emissions. The CDP ultimately represents a form of market self-regulation, attempting to overcome the limitations of the Kyoto Protocol. In fact, the CDP focuses on companies rather than on countries (which have sometimes been reluctant to develop stringent national requirements on emissions), and pressurises institutional investors to focus their attention on carbon emission and energy usage. One of the most challenging topics in today's environment is defining what the boundaries of a reporting entity are. Given the central role of the supply chain, the CDP provides an indication as to how to collect, manage and disclose climate-change information regarding entities included in the supply chain, and which often account for most of the emissions which could be managed indirectly by the company. The CDP

also focuses its attention on cities, and on the supply chain of governments, allowing them to manage suppliers' energy use more efficiently.

2.3.10. Reporting Standards

2.3.10.1. ISO Standards

The International Organisation for Standardisation (ISO) is an independent, non-governmental membership organisation comprising 163 member countries, which has been in existence since 1946, and is the world's largest developer of voluntary International Standards (ISO, 2015a). ISO has published 21 991 International Standards and related documents, covering almost every industry, from technology to food safety, agriculture and healthcare. (ISO, 2015b).

The first ISO Standard relating to the environment was the 14000 series which commenced in 1996. In 2003, 107 executives in multinational organisations recognised the ISO 14000 series as the most influential framework/standard on business practice (World Bank Group, 2003). It was acknowledged further that these standards might contribute to implementing other reporting guidelines such as GRI.

Many ISO standards can be certified; an exception being the social responsibility standard (ISO 26000) which provides guidance, not requirements. It cannot, therefore be certified, and instead aims to help corporations achieve best practices in social responsibility. In addition, ISO 26000 can be combined and incorporated with both the GRI G4 and the IIRC reporting framework (ISO, 2015).

2.3.10.2. AA1000

The AccountAbility Principles for Sustainable Development first appeared in the AA1000 AccountAbility Framework Standard published in 1999. During the consultations for the development of the first edition of the AA1000 Assurance Standard, published in 2003, the principles underwent significant debate and revision. The result was the commitment to three principles: materiality, completeness and responsiveness. These principles were at the heart of the AA1000 Assurance Standard published in 2003 [AA1000AS (2003)], and the AA1000 Stakeholder Engagement Standard published in 2005 [AA1000SES (2005)].

The purpose of AA1000APS (2008) is to provide organisations with an internationally-accepted, freely-available set of principles to frame and structure the way in which they understand, govern, administer, implement, evaluate and communicate their accountability (AccountAbility, 2008).

AccountAbility's AA1000 series are "principle-based standards to help organizations become more accountable, responsible and sustainable" (AccountAbility, 2015). They were created in 2010 to link other specialised standards such as *inter alia* GRI, ISO, through a common set of principles and processes, and to be a stand-alone framework on accountability (Adams & Narayanan, 2007). The series comprises a set of principles and process standards to provide guidance on sustainability challenges. It focuses on the reporting process, however, and not the reporting content.

AccountAbility (UK) has developed an assurance standard to offer reporters not only a meaningful alternative to the accounting profession's International Standard on Assurance Engagements (ISAE 3000), but also to offer stakeholders a more comprehensive assurance engagement. Increasingly, accounting firms are linking AA1000 to ISAE3000 (Busco *et al*., 2013) in order to meet growing stakeholder demand for meaningful assurance. While ISAE 3000 focuses on the quality of data, AA1000APS focuses on systems in place behind data capture and reporting, concentrating on defining material issues adequately through engagement with key stakeholders (Busco *et al*., 2013).

2.3.10.3. ISAE3000

The ISAE 3000 is a generic standard for any assurance engagement other than audits or reviews of historic financial information (GRI, 2013). ISAE 3000 has come under criticism for not having created an accounting system which the general stakeholder is able to comprehend and implement.

2.4. Motivation for sustainability Reporting in South Africa

The discovery, extraction and processing of mineral resources is regarded widely as one of the most environmentally and socially disruptive activities undertaken by business (Peck & Sinding, 2003). Warhurst (2001) notes that many of the environmental disasters or human rights incidents that have contributed to growing public concern about CSR over the past 40 years have taken place in the mining or petroleum industries.

Social and environmental impacts of mining are, of course, particularly significant in South Africa, where mining has remained a centrepiece of the economy for so long; and concerns are aggravated by mining companies' implication in South Africa's tortuous history (MMSD-SA, 2002). The impact of high unemployment and economic inequality has forced South African companies to pay close attention to the disclosure of environmental, social and governance (ESG) information in their annual reports (King, 2012). The events at Marikana, where several mineworkers lost their lives in industrial unrest due to, *inter alia*, the need for improved working conditions and wages (King, 2012), has made ESG information all the more relevant. There is therefore an increasing need for sustainable growth which would reduce inequality and poverty.

2.5. Sustainability Reporting in the South African mining sector

2.5.1. King Code on Corporate Governance

The very concept of "corporate governance" in South Africa is closely linked with the King Report's code(s) of corporate governance. The chairperson of the King Committee on Corporate Governance, Mervyn King, is described in literature as the leader of South African corporate governance (Andreasson, 2011). The King Committee was not convened as a result of significant crises, but rather a desire for the South African private sector to become competitive in the international business arena following the re-admission of the country to the global economy after the lifting of sanctions (Mallin, 2006).

The King Code on Corporate Governance is a set of guidelines for governance structure and operation of companies in South Africa. There have been four major editions, King I being issued

in 1994 as the first conceptual model based on a mix of codes of best practice and company law to regulate the relationship between shareholders, directors and corporations (Rossouw *et al.*, 2002). The code was not in response to any one particular corporate failure. It took cognisance of the need to align South African business practice with international governance standards, particularly in the initial years following political emancipation (Vaughn and Ryan, 2006). The focus was on high quality financial reporting and on the principles of transparency, accountability and ethical, all-inclusive business (Rossouw *et al.*, 2002; Hamann *et al.*, 2005).

In 2002, King II proposed a move from the narrow view on a firm's performance to more inclusive, triple-bottom-line reporting. Changes concerned, for example, the role and function of boards of directors and company officers, information technology, risk-management and social, health and environmental reporting. In particular, the need for sound audit services was included, to ensure the reliability of annual reports (Rossouw *et al.,* 2003; Diamond and Price, 2012).

The global financial crisis, persistent socio-economic inequality, resource constraints, climate change and mounting allegations of corruption in the public sector required a fundamental shift in existing corporate reporting frameworks (King, 2012; Solomon and Maroun, 2012). This culminated in the introduction of principles of integrated reporting in King III (IOD, 2009). The integrated reporting initiative driven by King III and the IIRC placed renewed emphasis on holistic, concise and balanced reporting. The objective was the provision of clearly integrated information about an organisation's strategy, risks and opportunities, and how this related to the social, environmental, economic and financial challenges facing the firm (Solomon and Maroun, 2012).

King III explicitly states that sustainability includes environmental, social and governance considerations (King, 2012). The conceptual model adopted by the King Code means that it does not provide a detailed framework for ESG disclosures. Consequently, several ESG-reporting initiatives – together with King III - influence the content of annual/integrated reports in South Africa (KPMG, 2012; Sustainability South Africa, 2013). Table 2 lists the most common codes or guidelines developed by either international institutions or multi-stakeholder frameworks.

Table 6: International/multi-stakeholder frameworks (KPMG, 2012; Sustainability South Africa, 2013)

Framework/Guidelines
United Nations Global Compact Principles (UNGCP)
United Nations Sustainable Development Goals (SDGs)
Organisation for Economic Cooperation and Development's Guidelines for Multi-national Enterprises (OECD MNE)
United Nations Principles for Responsible Investment (UNPRI)
Global Reporting Initiatives' G3 Reporting Guidelines (GRI G4)
International Standardisation Organisation (ISO) - ISO 26000: Social Responsibility (ISO 26000)
The Coalition for Environmentally Responsible Economies' Principles (CERES)
Social Accountability International - SA 8000 (SA 8000)
AccountAbility Principles Standard - AA 1000APS (AA 1000 APS)
GHG – WRI/WBCD
The Carbon Disclosure Project (CDP)
The Prince of Wales Accounting for Sustainability Project (A4S)
Institute of Directors in Southern Africa's Sustainable Development Forum
The Security Exchange Commission (SEC) Guideline on climate change disclosure

2.5.2. FTSE/JSE Responsible Investment Index

The JSE has developed criteria to assess ESG reporting practice, having been the first stock exchange in the world to do so. The JSE Social Responsible Index (SRI) was launched in May 2004, and developed to measure the triple-bottom-line performance of listed companies (JSE, 2004). These criteria take into account the South African context, although they are essentially based on a framework promoted by the UN Principles for Responsible Investment (UNPRI). The SRI was terminated in December 2015 and replaced with the FTSE/JSE Responsible Investment Index Series.

2.5.3. Mining Charter

In order to redress historic inequalities, the South African government released a Broad-based Socioeconomic Empowerment Charter for the country's mining industry in 2002 (RSA, 2002). It proclaims state sovereignty over mineral resources (private ownership had been common previously), and requires all companies to renew their prospecting or mining licences. The licencing process allows the government to support previously-disadvantaged South Africans in the industry under the rubric of 'black economic empowerment' (BEE). Although not providing prescriptive ESG disclosure requirements, the Mining Charter (revised in 2017) creates a framework for the transformation of the mining industry, and includes various targets that should be achieved by mining companies within a certain time frame. Among these targets are that any new prospecting right must have a minimum of 50%+1 black person shareholding, and that holders of mining rights must have a minimum of 30% black person shareholding (The Mining Charter, 2017).

2.6. South African Coal Industry Review

2.6.1. Introduction

This section of the report will analyse and review the current situation of the coal industry in South Africa. It will attempt to define the differences between the country's commitments to decarbonisation while continuing its reliance on coal. The market drivers, risks and dynamics will be outlined. This section will also provide insight into the effect of the downturn of the global market, oversupply issues, the impending carbon tax in South Africa, and the effect of the Independent Power Producer Programmes (IPP) on the industry.

South Africa has been a significant player in the global green economy sector, having made international commitments to reducing its carbon emissions, and releasing climate change legislation that includes a proposed carbon tax. Despite these commitments, South Africa forges ahead with substantial coal investments which include the development of new coal mines to meet the demands of new coal power stations, and the development of rail and road infrastructure to improve its export capacity. With most of South Africa's large-scale coal mines expected to reach the end of their lives by 2020 (Hartnady, 2010), the development of the Waterberg coal fields is seen as a necessity by the South African government (DMR, 2009). The country is, however, facing a lack of investment in new coal mines as a result of global oversupply, low commodity prices and regulatory uncertainty. The rise of renewables and gas combined with the downturn in demand in China has left the global coal market in a precarious position as the global energy landscape shifts.

The country proposes to diversify its energy mix with investment in renewable energy and the controversial nuclear energy plan to generate 9.6 GW (IEA, 2016). Much of the new capacity will be delivered through the IPP, allowing energy generation to be privatised through a structured bidding process.

2.6.2. Overview of the South African Coal Sector

While gold is often described as the mineral which sparked the growth of South Africa, it was in fact coal that enabled its rapid development. The growth trajectory of South Africa is based on an abundant supply of low-grade coal that provided cheap energy to industry and made South Africa an advantageous environment for mining houses, aided by the provision of cheap labour through racially-orientated policies.

Coal was first mined commercially in the 19th century and became particularly sought after once gold had been discovered in the Witwatersrand basin. Coal provided a cheap energy supply for the 19th century Transvaal Republic to power the fast-growing gold industry (including railways), as well as other minerals that were later discovered. Eskom, the national electricity utility, was founded in 1922 with the objective of providing cheap electricity to drive industrial development, and has subsequently used coal as its predominant source of electricity generation. Approximately 77% of all energy needs in South Africa are met by coal, and per capita CO_2 emissions are inordinately high considering the level of development (Death, 2014). New coal-

fired power stations Medupi and Kusile are the third and fourth biggest power stations in the world, while Sasol's Secunda plant is one of the largest point sources of CO_2 emissions anywhere in the world (Yeld, 2011). Sasol was created in the 1920s, converting coal into liquid fuels to meet South Africa's petrochemical requirements. Together, Sasol and Eskom are the biggest emitters of CO_2 in South Africa and dominate the climate debate.

Eskom and Sasol have provided the foundation on which modern South Africa is built. Without the cheap energy supplied by Eskom, many energy-intensive industries may have not been able to flourish; and without the fuel supplied by Sasol, the apartheid state may have struggled to meet the country's petrol demands, especially under sanctions. Coal remains at the heart of the South African economy: it alone supplies approximately 900 000 jobs and contributes a little over 1% to the GDP (CoM, 2014). Serious dependency on coal remains as most of South Africa's mining, manufacturing industry rely on the energy generated from coal.

The coal sector remains the highest generator of revenue of all commodities in South Africa, earning, for example, R 106 billion in 2016 (PWC, 2016). Most importantly the coal industry supplies South Africa with over 90% of its total electricity production: roughly 30% of its liquid fuels through Sasol, while approximately 70% of its total energy demand is met through coal (Burton Jesse & Winkler Harald, 2014).

South Africa is major coal producer and exporter, ranking 7th in global production and 5th in exportation worldwide (IEA, 2016). The country is traditionally a low-cost producer of coal and has the largest export terminal in the world located at Richards's Bay in Kwa Zulu Natal. It has the added bonus of being conveniently located between the Atlantic and Pacific coal markets (Eberhard, 2011).

South Africa is home to 3.5% of the world's coal reserves and is estimated to have reserves for a further century, although this estimation is widely contested. In 2016, 252.1 Mt of coal was produced, 70% of it being sold domestically and the remainder exported (Statistics South Africa, 2016). The South African Council of Geoscience estimated that the country had a coal reserve of 66.7 billion tonnes in 2011, compared with 55.3 billion tonnes in 1987. Meanwhile, 7.5 billion tonnes had been extracted within this period (Brendan, 2014). The increase was due to the new reserve estimates for the Waterberg coalfield in Limpopo. Waterberg reportedly accounts for 48.3 billion tonnes, or 72% of the total estimated reserve in South Africa (Department of Mineral Resources, 2009).

Table 7: Global hard coal exports and production in Million tonnes of Coal (Source: IEA, 2016)

Export	Mt	%
Australia	392.3	29.9
Indonesia	368.4	28.1
Russian Federation	155.1	11.8
Colombia	82	6.3
South Africa	**77.3**	**5.9**
United States	67.1	5.1
Netherlands	36.2	2.8
Canada	30.5	2.3
Kazakhstan	27.4	2.1
DPR of Korea	19.9	1.5
Other	55	4.2
World	1311.1	100

Production	Mt	%
China	3527.2	45.8
United States	812.8	10.5
India	691.3	9.0
Australia	508.7	6.6
Indonesia	469.3	6.1
Russian Federation	349.3	4.5
South Africa	**252.1**	**3.3**
Germany	184.7	2.4
Poland	135.8	1.8
Kazakhstan	107.2	1.4
World	7708.7	100.00

A large proportion of the steam coal for export and domestic markets is produced by eight mega-mines, each with a capacity exceeding 10 Mtpa. Seven are located in the central basin (Mpumalanga) and one is in the Waterberg basin (Eberhard, 2011). Five companies account for more than 85% of coal production in South Africa: Anglo-American, Glencore, Exxaro, Sasol and South32. The country has, however, made an attempt to develop junior mining companies which are presently having an increasing influence on the market.

A result of this has been a transition in the ownership structure of the South African coal industry. Many mergers and acquisitions have been in the name of Black Economic Empowerment (BEE), and have resulted in multi-national corporations reducing their South African coal assets. Government has directed Eskom to procure the bulk of its coal from mining companies with 50% plus one share black ownership by 2018. This is compounded by regulatory uncertainty, with proposals by government that coal could be declared a strategic mineral, resulting in the commodity being subjected to price or export restrictions. A consequence has been that companies such as Anglo American have considered withdrawing from the coal market, while BHP Billiton coal assets have been sold to South32, which operates independently.

2.6.3. Domestic coal use

65% of South African domestic coal is consumed by Eskom for electricity generation, while Sasol is the next largest consumer at 22%, producing liquid fuel from coal. Small merchants, who supply residential users and businesses account for 5%, while other industries which include metallurgy, steel, chemical, cement, agriculture, brick and tile account for the remaining 5% (Prevost, 2015).

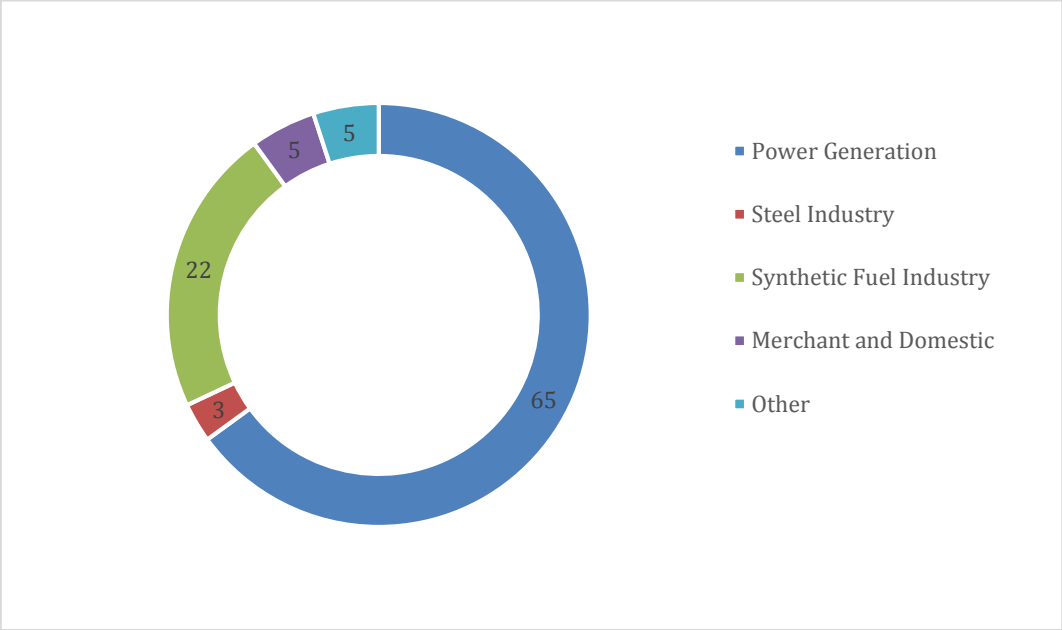


Figure 2: Domestic coal use in South Africa (excluding exports) (Prevost, 2015)

Eskom is by far the largest consumer of coal in South Africa. Between Eskom and South African Municipalities there are 28 existing coal-fired power stations, as well as the Medupi and Kusile power stations which are still under construction (Eskom, 2016).

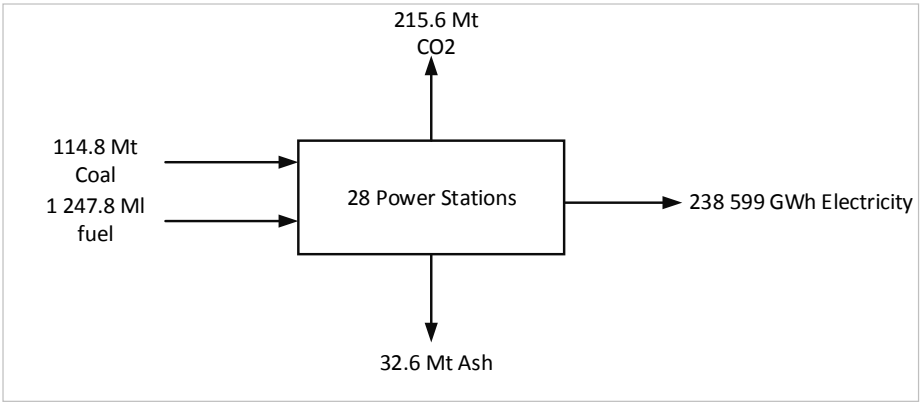


Figure 3: Eskom input and output (Eskom, 2016)

2.6.4. South African Coal Market Development

Coal has been central to the South African economy since the discovery of gold and diamonds in the late 19th century. It became particularly dominant in the 1970s, however, when the state-owned utility, Eskom, expanded its electricity generating capacity from 6 500 MW in 1969 to over 25 000 MW in 1990, through the construction of several large coal-fired power stations (Marquard, 2006). Furthermore, Coal became crucial to South Africa's liquid fuel demand in the 1970s when Sasol commissioned a coal-to-liquid plant (Burton Jesse & Winkler Harald, 2014). In addition, the government changed its policy toward the export industry with the development of a huge coal terminal in Richards Bay, Kwa Zulu Natal. The terminal was supplied directly by train, solving many of the logistical issues that had plagued other regions of the country.

From the 1940s to 1970, South African coal was the cheapest in the world, serving as a catalyst to railways, mining houses and other important industries nationally. The coal price during this period was controlled by the state, and strict regulations were set on exports. There was, however, a significant shift during the 1970s when the state embarked on its massive electrification expansion, and domestic prices increased significantly. The export industry was boosted by the 1973 oil crisis, leading to a rise in global demand and the price of coal.

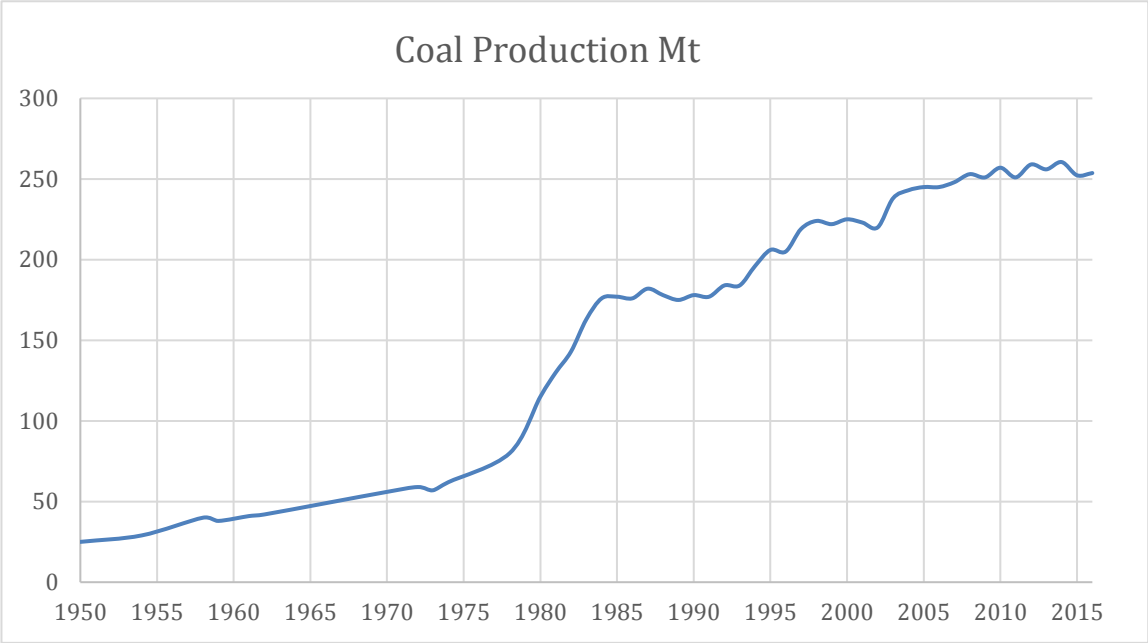


Figure 4: Coal Production in South Africa (1950-2016)

2.6.5. Export Industry

South Africa is the world's fifth largest coal producer, and exporting approximately 25% of its production. The higher-quality coal is generally reserved for exportation, while low-quality coal is used by Eskom domestically. Most of the country's coal is exported through the Richards Bay Coal Terminal (RBCT). In 2015, 75.4 million tonnes of coal were exported to 42 countries. The terminal, however, has a capacity of 91 million tonnes (RBCT, 2016).

RBCT is owned by the coal mining companies that use it, including Anglo American, South32, Sasol, Exxaro, ARM Coal and Glencore among others. The RBCT receives coal from 49 mines, the majority of which are in Mpumalanga and Kwa-Zulu Natal.

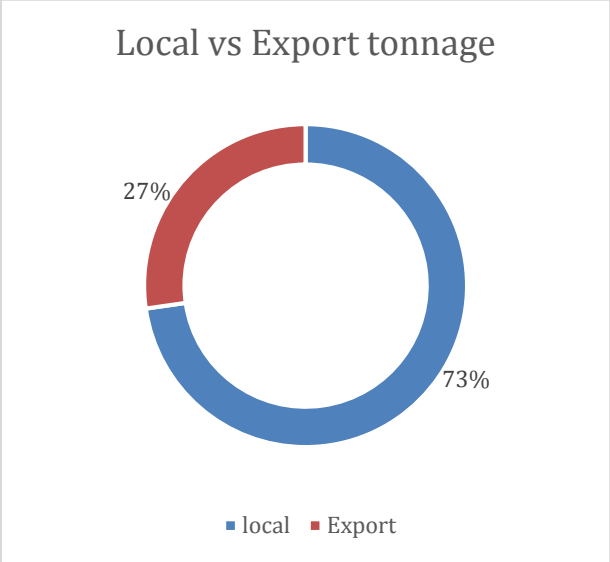


Figure 5: Percentage of coal exported vs. traded locally (SA stats, 2016)

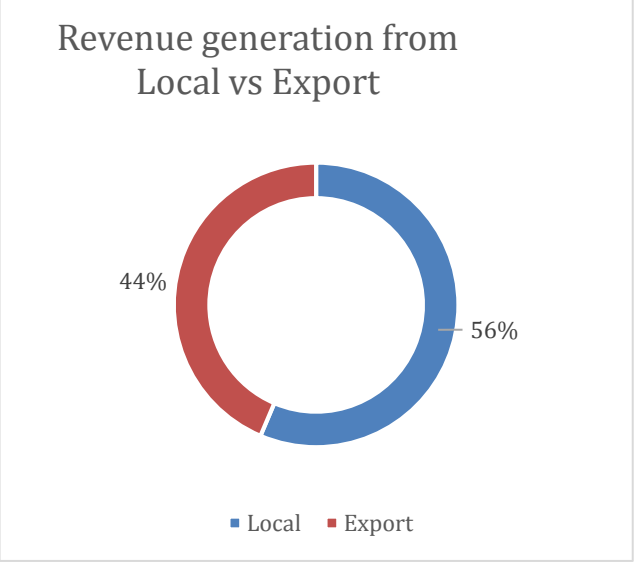


Figure 6: Percentage value generated by coal exported vs. traded locally (SA stats, 2016)

While the tonnage of coal exported amounts to 44% of the total revenue generated from coal sales, it represents only 27% of the tonnage traded. This indicates that the export product is substantially higher in value than the domestic product. Indications are that the domestic market, however, is becoming more valuable to South African coal producers as, traditionally, export value has fluctuated around 50% of the total value and represented between 20 to 30% of total production by tonnage since the 1990s (Marquard, 2006). 2016 data shows that the domestic market has taken up a greater share of the total value than expected. This is due to the reduced price of export coal, which has been down 60% since 2012, as well as to other policy and regulatory issues that have been influencing coal exports negatively.

2.6.6. Future of South African Coal

South African coal production is concentrated in the central basin, the Witbank, Highveld and Ermelo coal fields, where most of South Africa's power stations are located (Eberhard, 2011). Production from both Witbank and Highveld coal fields represent a little over 80% of the total run-of-mine coal in the country (DMR, 2009).

Based on geographic considerations, and variations in the sedimentation, origin, formation, distribution andquality of the coals, 19 coalfields are generally recognised in South Africa. Whilst many of the coalfields have been extensively explored and exploited, those in the north of the country have until recently received much less attention. Four coalfields occur partly or wholly within the Limpopo Province of South Africa and these may contain as much as 70% of South Africa's remaining coal resources. These coalfields in particular have been the focus of recent exploration due to the presence of large coking and thermal coal resources, as well as for their coal bed methane potential, and these resources need to be unlocked with regards to creating maximum benefit and minimal environmental degradation (Hancox & Gotz, 2014). These coal fields have also been said to require specific types of washing plant and higher-skilled labour in order to turn the coal into a usable product (DMR, 2009). This, combined with water and infrastructure issues, hampers the value of coal mining in the Waterberg. The mining industry has encouraged development of the Waterberg coalfields: companies such as Exxaro, Anglo American, Sasol, Waterberg Coal Company and others have prospecting rights in the region.

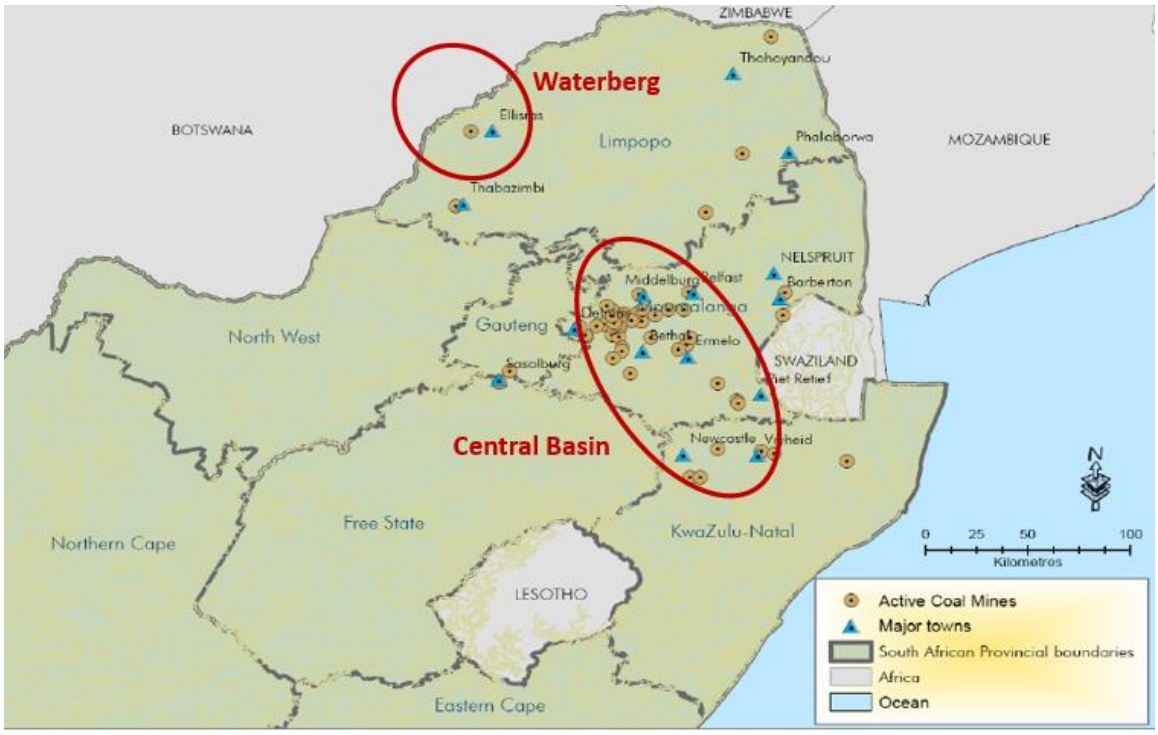


Figure 7: Map of Active South African Coal Mines (Statistics South Africa, 2016)

2.6.7. New South African Coal Power station Developments

2.6.7.1. Coal baseload Independent Power Producer programme (CBIPPP)

The present government has been considering the development of a third new large coal power station, Coal 3, under a bidding process of the Department of Energy's Coal Baseload Independent Power Producer Procurement Programme (CBIPPPP). Started at the end of 2014, the programme is South Africa's first procurement programme which allows private companies to produce energy and sell it to Eskom. It is operated along lines similar to the Renewable Energy Independent Power Producer Procurement Programme (REIPPP), which commenced in 2010 and has been lauded internationally as a success.

Only two projects have been announced as successful bidders: the 557.3 MW Thabametsi project located in the Waterberg, and the 306 MW Khanyisa project in Mpumalanga. The Thabametsi and Khanyisa projects have a combined investment value of R40.16 billion, and propose to deliver power at prices below R820/MWh, as stipulated by the tender requirements.

The Exxaro led, Thabametsi project has however, subsequently been in question, the High Court having, in March 2017, ruled in favour of the environmental justice organistion, Earthlife Africa (ELA), on the basis that climate change impacts of the proposed power station have not been considered. The GHG emissions report estimates that the power station will generate over 8.2 million tonnes of carbon dioxide per year, and over 246 million tonnes of carbon dioxide over its lifetime (Savannah Environmental, 2016). This has been South Africa's first climate-change court case, which may have significant consequences regarding the country's future coal-based energy supply.

2.6.7.2. Medupi

Once completed, the Medupi power station will be the fourth largest coal power station in the southern hemisphere, with a total capacity of 4 764 MW and an estimated cost of R145 billion. Eskom is building the station near Lephalale in Limpopo.

The Medupi station will be the largest of its kind, using direct dry cooling which employs air instead of water to cool the steam emitting from the turbine. This will reduce water constraints felt by the arid South African environment that has been challenged with severe water shortage issues.

The project has suffered numerous delays since commencement of construction in 2007, and the projected cost of construction has increased significantly since the original estimation. Two of the six units of the power station are now operational and synchronised to the national grid. Unit 6 is now adding 794 MW, having come online in August 2015, and unit 5 has added 796 MW since coming online in December 2016. These units have eased the burden on Eskom in meeting national demand. The revised completion date for the entire project is 2020. Medupi will be

supplied by coal from Exxaro's Grootgeluk mine, located just north of the site. Eskom has placed a contract with Exxaro to supply 14.6 Mt of coal per year for 40 years (Eskom, 2017a).

2.6.7.3. Kusile

The Kusile power station will also comprise six units, each will have an installed capacity of 800 MW, delivering a total capacity of 4 800 MW. The power station will use the same dry cooling technology as Medupi; however it will be the first to install flue-gas desulphurisation (FGD), technology employed to remove oxides of sulphur from exhaust flue gases in power plants. This is to ensure that the plant meets air quality standards, particularly as the area is located in air-shed priority area. The entire project is expected to come online in 2022 and at an estimated cost of R118.5 billion. In March 2017 unit 1 was synchronised, bringing 800 MW onto the grid. The operational life of the station is estimated to be 60 years and the coal will be sourced from four local coal mines (Eskom, 2017b).

2.6.8. Minerals Energy Complex

Crucial to understanding power dynamics and key networks in the development of the modern economy of South Africa is the mineral and energy complex (MEC), first introduced by Fine & Rustomjee in 1996. The MEC, founded on intrinsic links between state corporations, private capital, and the country's complex legacy of apartheid, provides both a description of the nature of production and consumption in South Africa's economy regarding the energy and mining sectors and associated sub-sectors of manufacturing, as well as a theoretical framework for analysing power relations and key networks in the country's political economy (Freund, 2010).

The MEC, central to the socio-technical 'regime' referred to above, lies at the "core of the South African economy, not only by virtue of its weight in economic activity but also through its determining role throughout the rest of the economy" (Fine and Rustomjee 1996).

The MEC refers to a system of accumulation dating back to the 1870's, where the state developed its growth path from the provision of cheap coal-based electricity which served mining and mining beneficiation-related activities, along with cheap labour divided by racially-orientated policies. The system has continued to shape post-apartheid South Africa, and has built economic dependence and vested interests in favour of the export-orientated mining industry.

The earliest beginnings of the MEC began as a relationship between coal, electricity production and gold. With coal producing the cheap electricity which supplied the gold industry. This subsequently developed into a more complex network which included other minerals and petrochemical-based industries (Marquard, 2006).

The historical influence of a small number of large, influential, resource-based conglomerates with the ability to sway policy and receive privileged access to cheap energy, tax breaks and infrastructure is a central characteristic of the MEC (Roberts, 2007). These sectors continue to influence the state and the direction of the economy, and have been attached institutionally to a highly concentrated structure of corporate capital, state-owned enterprises and other organisations.

A central stakeholder in the MEC is South Africa's state-owned, vertically-integrated monopoly, Eskom, which has been the sole transmitter of electricity via the country's high voltage transmission grid, generating 96% of the nation's electricity. Eskom has been at the centre of multi-million rand mega-deals since the 1990s, and offers the world's cheapest electricity to aluminum and steel plants. Another key stakeholder in the MEC is the coal industry, which currently supplies coal for 93% of the country's electricity generation. Approximately 80% of the country's coal supply is controlled by five companies. These large multinational corporations have evolved from the apartheid era and, while Eskom is their biggest customer for coal, they in return are Eskom's biggest customer for electricity. They wield considerable influence over policies in terms of coal supply and policies governing electricity generated from that coal (McDaid, Austin and Bragg, 2010).

2.7. The Green economy

The concept of greening the economy is not new, but has re-emerged as a dominant theory in the global debate on sustainable socio-economic development. There is no universally agreed-upon definition for the green economy, and interpretations differ as protagonists prefer a variety definitions depending on their differing agendas and viewpoints. Stated simply, a green economy is one which is resource-efficient, low carbon and socially inclusive. The green economy concept has started to adopt a more inclusive aspect which is particularly important for developing nations such as South Africa where high levels of inequality are experienced.

The "green economy" phrase was reinvigorated in public policy discussion after the financial crisis of 2008, when the United Nations Environment Programme (UNEP) launched its Green Economy Initiative (GEI), and other international institutions such as the Organisation for Economic Co-operation and Development (OECD, 2011) and the World Bank (2012) enthusiastically promoted the idea. The concept has much older origins, however, with clear interpretations appearing in the 1980s in a report by the British government, Blueprint for a Green Economy (Pearce, Markandya and Barbier, 1989).The main principle of the green economy was that the environment should be accounted for within economic analysis. Environmental degradation should be seen as a market failure, and therefore should be included as such within traditional economic accounting principles. If the environment continued to be identified as a 'free' resource, it would eventually be depleted or polluted. For Pearce, 'green' meant 'sustaining the overall stock of natural resources so that they are available for the present as well as the future' (Pearce, 1993). The explanation follows that people use natural capital because it is valuable, but are losing natural capital as it is 'free' in traditional auditing process, a green economy would be one that integrates natural capital accounting into economic development policy and strategy.

In understanding how green economy re-emerged as a centrepiece in global discourse, it is important to understand the effect of two global crises that shaped public and political opinion: namely, the 2008 financial crises and the climate change crises. The combined effect of these global issues raised awareness about sustainability concerns, and re-legitimised green concepts within mainstream political circles. There was an understanding that current economic issues could not be solved along traditional development paths, as had been the case in the financial recessions of the 1930s and 1970s; a new sustainable economic strategy would need to be employed. This spurred enthusiasm for the creation of a new economy run along a more sustainable growth path. The notion of the state-regulating private enterprise to ensure responsible operating standards, as well as green finance in the banking sector, became a popular concept. Protagonists in this new green order included environmentalists who were eager to incorporate ecological principles into the economy, and others who saw the green revolution as a way of raising finance and investment in order to boost economic growth. These diverse aims often create ambiguity around the green economy discourse, with some preferring a focus on innovation and investment while other focus on equity and reduced risks. Carl Death (2014) provided a coherent disaggregation of the diverse discourse that can be found with the green economy. He stated that there are four clear and distinct discourses that can be identified in theory but often overlap in practice and, when isolated, may be seen to be competing priorities.
Aiding the rise to prominence of the green economy has been the re-thinking of climate change. Much climate change literature has focused on the development of clean–technologies and reduction in emissions to achieve climate stabilisation. This, however, has been criticised as reductionist thinking which fails to recognise development as the true cause of emissions. This

has resulted in a paradigm shift of how development and macro-economic policies are constructed. Climate goals should be considered development goals, and deeper understanding and the key to combating climate change lies in the transformational change in development paths (Winkler and Marquard, 2009).

Table 8, below, summaries the four distinct discourses on the green economy by Death (2014) and provides a basic framework with which to understand the various aspects surrounding it.

Table 8: Summary of Death's (2014) green economy discourses

1. Green Revolution • A radical and revolutionary transformation of economic relationships to bring them in line with natural and ecological limits. • Supported by deep ecologists, eco-feminists, and indigenous peoples. • A central tenet is that economic systems require 'greening' to resolve contradictions and end systemic exploitation of nature.	**2. Green Transformation** • Best encapsulated by the Brundtland report's vision of sustainable development as re-alignment of prevailing growth models and development paths. • Envisages a change in the current economic system but the basic elements will remain the same. • Has a specific focus on social justice, equity and redistribution. • Growth is seen as a driver of the process but not the primary aim. • Typical policies include Keynesian strategies of public investments in high tech industries and green jobs.
3. Green Growth • Green markets seen as an economic opportunity. • Businesses have sensed there is an opportunity in 'going green'. • It views the current economic system as inefficient and that states there are opportunities for cleaner growth. • Growing economies in Asia, Latin America and Africa seem to present new markets for 'going green'. • Rather than focus on limits and scarcity, emphasis is on new markets, new services and new forms of consumption.	**4. Green Resilience** • Is viewed as reactionary and cautious. • Is fundamentally an attempt to protect the status quo and is the least radical of the four discourses. • Growing concerns over environmental degradation, climate change and resource depletion have convinced many that alternatives need to be found in order to maintain the status quo. • There is a dominant theme of caution and scepticism in this discourse.

2.7.1. Green Economy: Concepts and Definitions

A United Nations 2011 report, entitled, *The Green Technological Transformation,* identifies five key objectives of an inclusive, growth-orientated, green economy, incorporating:

- Reduction of resource requirements in general, and energy requirements in particular, in both absolute terms and relatively, per unit output;
- Substitution of renewable for non-renewable resources, given the total resource use;
- Substitution of biodegradables for non-biodegradables at any given level of output or waste;
- Reduction of waste (including pollution) at any given level of resource use; and protection of biodiversity and ecosystems.

Table 9, below, describes the six key aspects of the green economy as characterised by the United Nations, with each aspect accompanied by benefit flows.

Table 9: UNEP Summary of key aspects of the green economy and their benefit flow. (United Nations, 2011)

Aspects of the green economy	Benefit flows
A Green economy recognises the value of, and invests in, natural capital.	Reducing deforestation and the support of agriculture and rural livelihoods.
	Greening agriculture allows the world's growing population to be catered for without hindering the resource base.
	Increasing water supply through effective policies to increase investment in supply and efficiency.
A Green economy is central to poverty alleviation.	Increasing investment in natural assets allowing low-income communities to earn a livelihood.
	Investing in water and sanitation services for the poor.
	Renewable energy can play a cost-effective role in supplying low-income rural districts with energy supply.
A green economy creates jobs and enhances social equity.	A shift toward a green economy would create a shift in employment that should retain and maintain at least as many jobs as previously.
	In short-, medium-, and long-term scenario projections, agriculture, construction and forestry sectors will experience job growth.
	Allocating a minimum of 1% of global GDP to raise energy efficiency and expand use of renewable energy will create additional jobs, while delivering renewable energy.
A green economy substitute's renewable energy and low carbon technologies for fossil fuels.	Renewable energy presents economic opportunities.
	Government policy has a vital role to play in creating incentives for investing in renewable energy.
A green economy promotes enhanced resource and energy efficiency.	Recycling and energy recovery from waste are becoming more profitable and should be encouraged when waste streams contain valuable materials.
	Manufacturers have untapped opportunities for enhancing resource efficiency.
	Promoting green cities raises efficiency and productivity.

A green economy delivers more sustainable urban living and low-carbon mobility.	The greening of most economic sectors would reduce GHG emissions drastically.
	A strategic policy agenda that integrates greening of a range of key economic sectors would create synergies and promote long-term mitigation scenarios.

2.7.2. South Africa and the Green Economy

South Africa has been a prominent player in the global discussion on climate change and the green economy. It has hosted key events such as the 2002 Johannesburg World Summit on Sustainable Development and the 2011 Durban Climate Change Conference. It has pledged to reduce national emissions at the 2009 Copenhagen COP15 conference, has been a signatory of the United Nations Framework Convention on Climate Change, and in 2014 South Africa was placed in the top 10 countries for renewable energy (RE) investment by UNEP. It has set up a globally acknowledged renewable energy procurement programmes and has conducted in-depth scenario analyses for energy and climate change.

In May 2010 South Africa hosted the Green Economy Summit, with the aim of reaching a resource-efficient, low-carbon and pro-employment growth path; while in 2011 the Economic Development Minister announced a new Green Economy Accord whose aim was to create jobs and was to be supported by the Green Fund, set up with R800 million, and intended 'to provide catalytic finance to facilitate investment in green initiative that will support South Africa's transition toward a green economy'(Gordan 2013, Green Fund 2012).

South Africa has made high profile commitments in favour of a transition toward a green economy and has backed up these statements with policies and investment in a green South African economy. This commitment has subsequently been captured by Jacob Zuma in his address to the Green Economy Summit, in which he stated the following:

There is great opportunity in the development of industries that combat the negative effects of climate change. South Africa needs to develop strong capacity in green technologies and industries. Through our actions, we need to respond to the notion that there is a trade-off to be made between faster economic growth and the preservation of our environment. We must be able to prove that faster economic growth can be achieved alongside the sustainable management of our natural resources. (Zuma, 2010)

The following year, Trevor Manual, Minister in the Presidency and Chairman of the National Planning Commission, stated the following in his address to the National Assembly in June 2011:

Our economic path, our settlement patterns and our infrastructure all combine to place our country on an unsustainable growth path from a resource utilisation perspective. We are the 27th largest economy in the world but we produce more carbon dioxide emissions than all but eleven countries in the world. We are a water scarce country but we use our water inefficiently. We have to change these patterns of consumption and we have to learn to use our resources more efficiently. We must do this with appropriate consideration for jobs energy and food prices. (Manuel, 2011).

These statements capture different aspects of South Africa's commitment to a green economy. While President Zuma's focus is on economic growth, innovation and investment in green technology, Trevor Manual highlights the environmental necessity for the transition toward a green economy as well as the unsustainable nature of South Africa's current growth path. While

there is no single South African policy that outlines the country's agenda to transition toward a green economy, there are several policies and strategies in place which are outlined in the following section.

Table 10: National policies, strategies and plans linked to the green economy

Name of Policy/Strategy	Goals	Department
National Development Plan	Specific targets for energy generation and carbon emissions	The Presidency
New Growth Path	To contribute toward creating 300 000 jobs from green economy programmes	Economic Development Department
Industrial Policy Action Plan	Targeting of development in green industries, renewable energy and energy efficiency	Department of Trade and Industry
National Strategy for Sustainable Development and Action plan	Specific programmes that support the green economy, thereby generating green jobs	Department of Environmental Affairs
National Environmental Act	To Integrate good environmental practices into all developmental activities through the provision of a framework and specific guidelines	The Presidency
National Water Resource Strategy	To ensure the provision of potable water and sanitation for all people, especially for the poor and previously disadvantaged	Department of Water Affairs
The Long Term Mitigation Scenarios	To provide projected scenarios for policy development choices	Department of Environment Affairs and Tourism
Climate Change Response Strategy	Generating green jobs while limiting losses in brown industries	Department of Environmental Affairs
National Skills Development Strategy	To support skills for the green economy	Department of Higher Education & Training
National Green Economy Summit and Reports	The report released highlights the need to develop a job-intensive green economy.	Department of Environmental Affairs
Integrated Resource Plan	17.8% of new electricity generation from renewable energy by 2020	Department of Energy
Green Economy Accord	To implement a wide range of commitment, to mobilising the private sector, communities and government into creating 5 million new jobs in the green economy.	Economic Development Department
10 Year Innovation and Global Research Plan	To develop a centre of excellence with climate change research	Department of Science and Technology
National Waste Management Strategy	T increase the number of jobs in waste services, recycling and recovery sectors	Department of Environmental Affairs
National Biodiversity Strategy and Action Plan	To set out a framework and a plan of action for conservation and sustainable use of South Africa's biological diversity	Department of Environmental Affairs and Tourism

From the policies outlined in Table 8 it is clear that South Africa has taken the initiative to drive the transition toward a green economy. Coherence as well as alignment between policies and government departments have been criticised, with some policies proving ineffectual and isolated. This is caused by various factors, such as lack of coordination and communication between government departments, the difference in mandate of departments, and diverse vested interests of government officials.

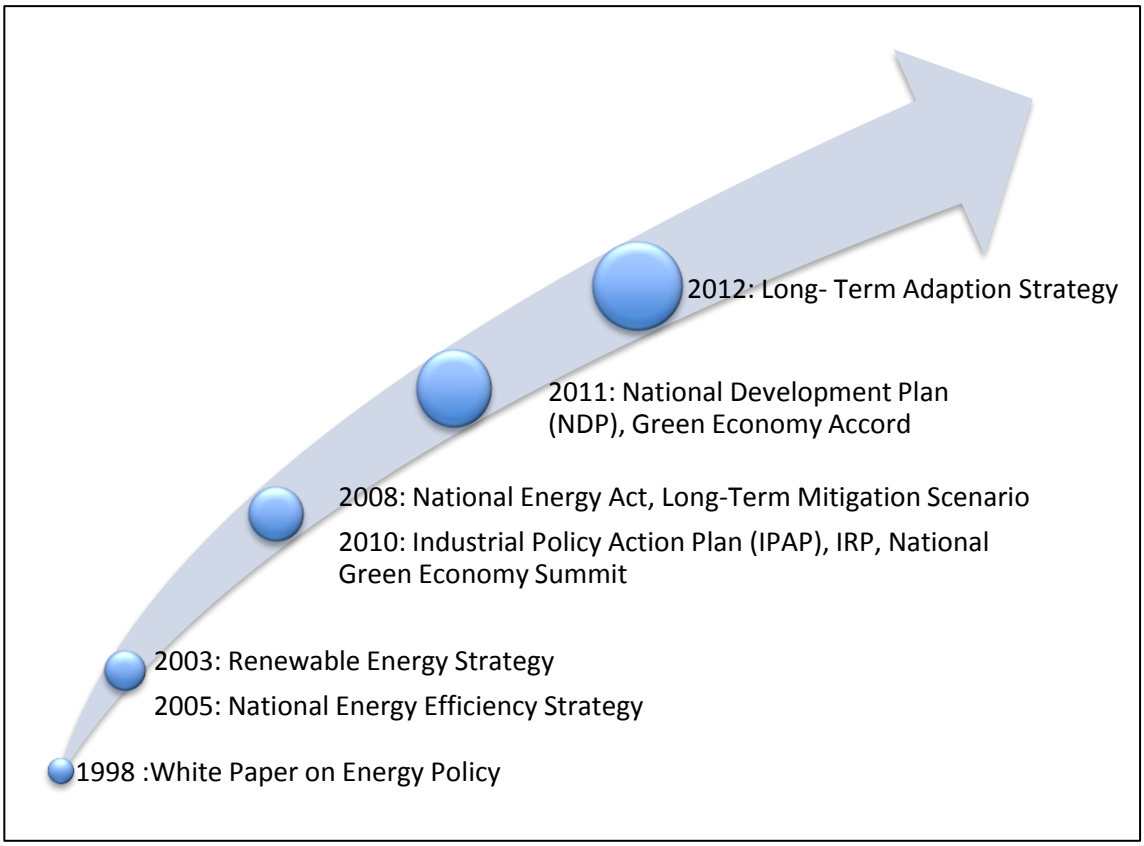


Figure 8: Capturing key South African Policy Developments

While it is difficult to identify the individual effects of the policies, the 1998 White Paper on Energy Policy was truly ground-breaking from a South African perspective, and initiated the country's investigation into renewable energy. It was especially revolutionary given the reliance on coal to drive growth that had existed since the 60s. It gave government a mandate to support renewable energy, to manage energy-related impacts and to improve access to energy, while recognising the deep-rooted inequalities in the energy sector. The 1998 Energy Policy White Paper showed foresight in recognising that renewable energy technologies would become an important part of the future, and that no time should be lost in developing South Arica's abundant renewable energy resources.

The second major policy was the Renewable Energy White Paper of 2003. This policy derived its authority from the constitution, and committed government to a set of broad targets. These included; the reduction of energy-related emissions and work towards the establishment of a renewable energy industry. This paper identified the factors needed to create a renewable energy

industry, such as financial and legal instruments, technological development, capacity building, education and governance.

2.7.2.1. Drivers that led to Green Economy discourse in South Africa

It is important to analyse which specific factors played a role in South Africa adopting green economic policies. Some of the drivers are rooted in global discourse on sustainability, while others are rooted in the natural constraints of South Africa. Unfortunately, global discourse has played a significant role in shaping South African policy which has, at times, caused the policy to be developed in a top-down fashion rather than being rooted in the natural factors of the South African context. Figure 9 below captures some of the main drivers behind the adoption of a green economy in South Africa.

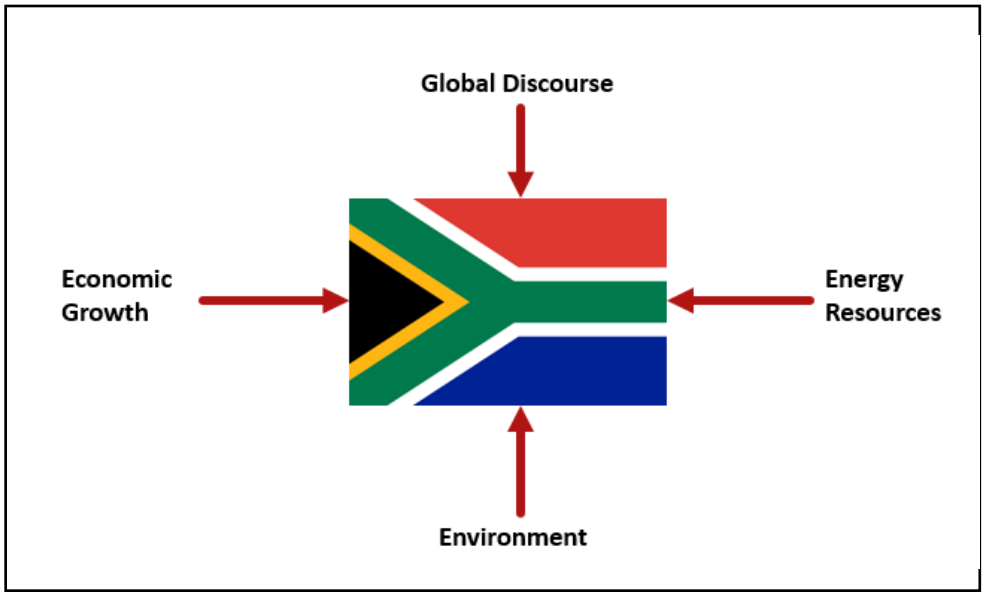


Figure 9: Drivers to South Africa's policy changes toward a green economy

As Minister Trevor Manual highlighted earlier in this literature review, South Africa's growth path is unsustainable and needs a sustainably-orientated transition. Some of the reasons for the unsustainable nature of the current economic system are outlined below:

- Current economic activities have produced major adverse environmental impacts in terms of air, water and land pollution, and have threatened ecosystems and biodiversity significantly.
- Non-renewable resources are being depleted rapidly.
- South Africa's long-term investments have made it dependent on coal, and placed it on an unsustainable growth path.
- The current economic system has not succeeded in creating jobs, nor in alleviating poverty and inequality.

International drivers will now be discussed, with a timeline of significant policies and conferences depicted in the table below.

Table 11: Drivers in South Africa's transition to a green economy at a global level

Policy	Date
Vienna Convention for the protection of the Ozone layer	1985
Montreal Protocol on Substances that deplete the ozone layer	1987
Un Framework Convention on Climate Change	1992
Kyoto Protocol	1997
Greenhouse Gas Protocol	2004
Ratification of the Kyoto Protocol	2005
ISO 14064: For Greenhouse Gas Accounting and Verification	2006
Bali Roadmap	2007
Copenhagen Accord	2009
Green Stimulus Packages	2009
UNEP Green Economy Initiative	2009
Green Climate Fund Pledges	2010
Cancun Agreements	2010
The Carbon Neutral Protocol	2010
UN International Year of Sustainable Energy for All	2011
COP17	2011
RIO+20	2012
COP18	2012
COP21 (Paris Climate Agreement)	2016

South Africa supported the United Nations Framework Convention on Climate Change (UNFCCC) which included a commitment to the Kyoto Protocol in 1997, and then released its National Climate Response Strategy in 2004. It became clear that South Africa was taking the issue of climate change seriously and would align domestic policy accordingly. Internationally, the period 2005-2008 has been described as the watershed years for climate science (Raubenheimer, 2011). There was the publication in 2006 of Nicolas Stern's review of the *Economics of Climate Change*, Al Gore's documentary *An Inconvenient Truth*, released in the same year, and the Intergovernmental Panel on Climate Change's (IPCC) *Fourth Assessment Report* in 2007.Research also began to reveal South Africa's extraordinary emissions resulting from its coal-based economy. Of the world's production of 49000 Mt of carbon dioxide in 2004, South Africa produced approximately 440 Mt, or roughly 1.5% of the global figure. The World Resource Institute's Climate Data Explorer (WRICDE) placed South Africa as the nineteenth highest emitter in the world in 2012 (World Resources Institute, 2015).

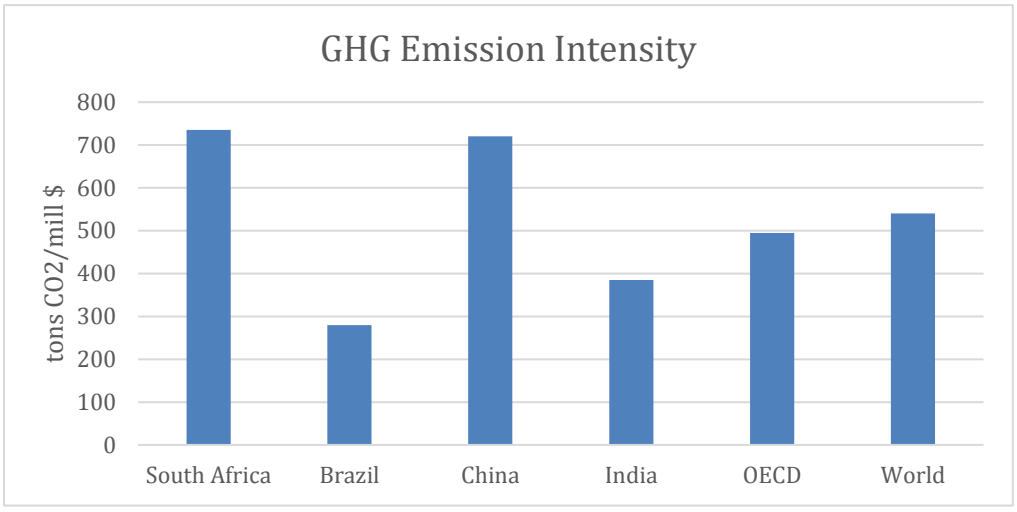


Figure 10: South Africa's emissions intensity (emissions per unity GDP) compared with others (Raubenheimer, 2015)

Figure 10 shows that South Africa's emissions are high compared with those of developed and developing nations. South Africa's emissions per capita are even higher than those of India and China, whose economies are also coal-based (Raubenheimer, 2015). It becomes clear that, if South Africa wants to be a true leader in climate change, it will have to make significant structural transformations to its growth path.

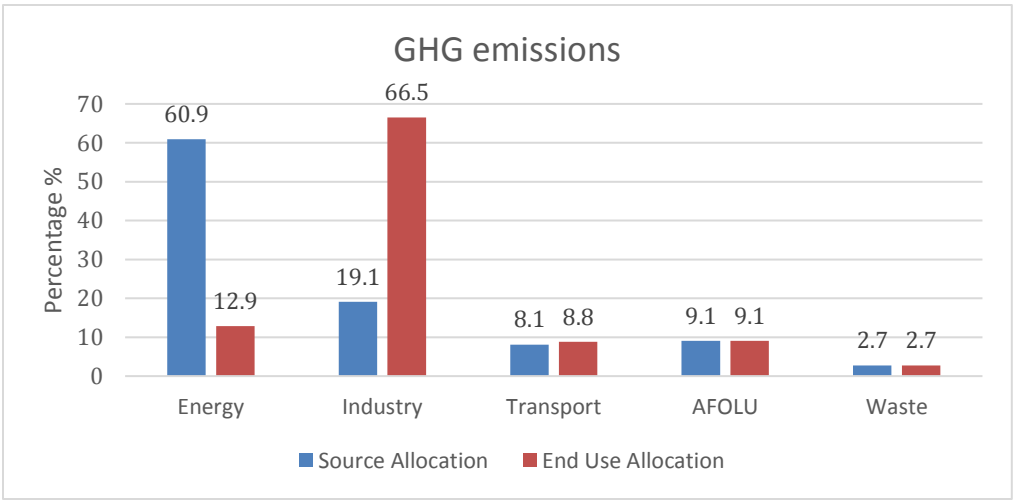


Figure 11: Sectoral breakdown of South Africa's greenhouse gas emissions in 2010 (Montmasson-clair, 2015)

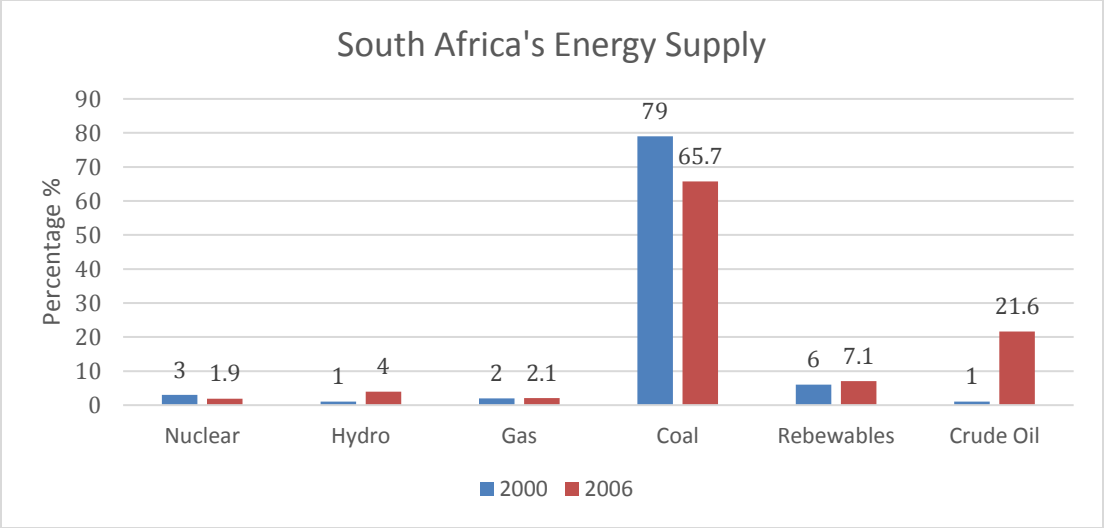


Figure 12: Breakdown of South Africa's Energy Supply 2000-2006 (Raubenheimer, 2015)

Figures 11 and 12 highlight South Africa's emissions by sector and energy supply, respectively. This shows that energy and industry are the predominant sectors contributing toward greenhouse gas emissions, while coal is the primary source of energy in South Africa.

2.7.3. Long-Term Mitigation Scenario

The Long Term Mitigation Scenario (LTMS) is of particular importance in South Africa's transition to a green economy. It is a unique process undertaken to address the issue of reducing South Africa's GHG emissions. The LTMS has brought business, labour, NGOs and government to remarkable levels of consensus regarding a set of evidence-based scenarios for reducing GHG emissions (Winkler, 2010). The aim of the LTMS was to provide sound scientific analysis from which cabinet could draw up a long-term climate policy.

South African Government Ministers launched the LTMS process in 2006, and completed it in 2008. The LTMS objective included:

- Nationally, to develop robust and broadly-supported scenarios to lay the basis for long-term climate policy;
- Internationally, to provide South African negotiations on the future of the climate strategy after 2012.

The LTMS process was run by four research teams who gathered large amounts of data to conduct energy modelling, analysis of non-energy emissions, macroeconomic modelling and assessments of vulnerability and adaptation

The 'Growth without Constraints' graph curve depicted in figure 13 shows the path South Africa would follow if it adopted no carbon restraints, while the 'Required by Science' graph curve represents the path needed for South Africa to stabilise the concentrations of GHGs in the atmosphere.

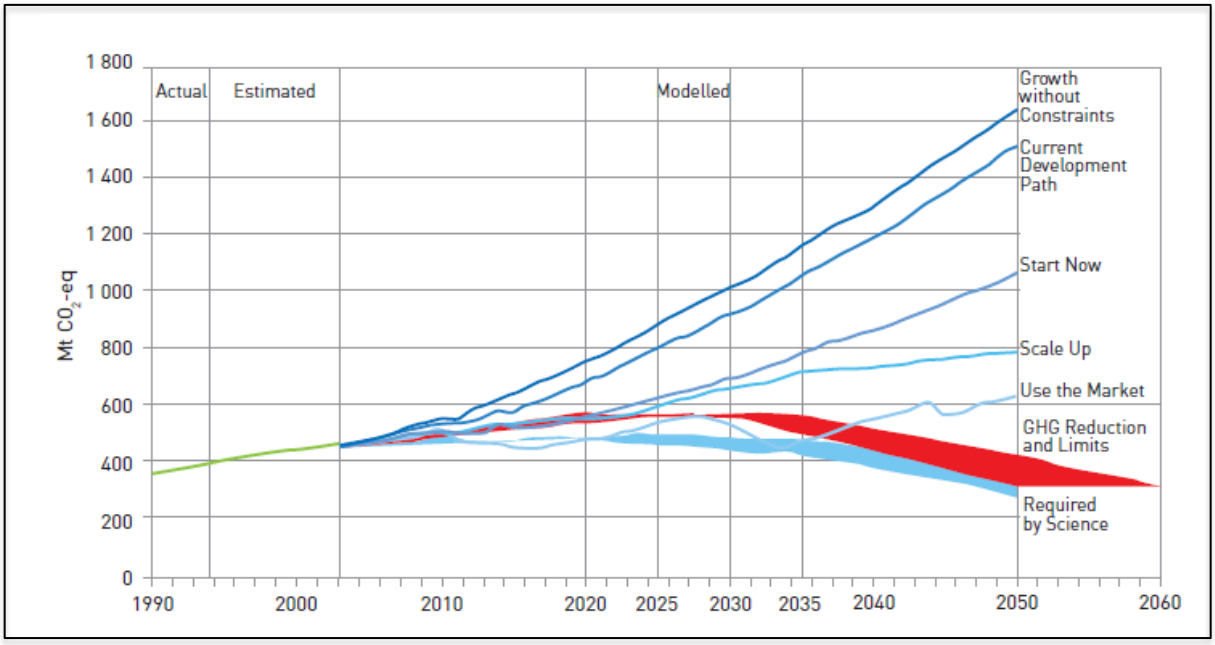


Figure 13: Strategic scenarios produced by the LTMS process (Winkler, 2010)

The LTMS suggested that energy efficiency and a cleaner fuel mix are significant mitigation actions, but the major challenge is to change the structure of the energy-intensive nature of the South African economy. The LTMS recommended a transition toward a low-carbon economy, which would mean moving away from South Africa's traditional coal-intensive path.
South Africa's cabinet approved the 'peak, plateau and decline' (PDD) GHG emissions trajectory in 2008, after the LTMS teams had submitted their report. Taking a long term view, the goal was to make a transition to a low-carbon economy. The outline was for emissions to peak during 2020-2025, then plateau for approximately a decade, and then decline (Winkler, 2010). This was an ambitious decision, and remains a hotly-debated topic to date. This decision was made at the highest levels of government.

The key findings of the LTMS process, illustrated in Figure 13, are that:

- *The Growth without constraints* scenario would be beneficial to the economy, but would result in a four-fold increase of emissions unlikely to be acceptable to the international community;
- a significant effort will need to be made for South Africa to reach the *Required by Science* scenario, with large-scale reduction in GHG emissions being necessary to reach the target;
- certain mitigation options are immediately applicable. These include energy efficiency, electricity supply options, CCS, transport efficiency and people-orientated strategies.
- The key to success will be strong, committed and engaged South African leadership in government, business and civil society, coupled with international alignment and active support.

2.8. South Africa INDC

The Paris Climate Agreement requires each country to submit its own intended nationally determined contributions (INDC's). South Africa's INDC is premised on the adoption of a comprehensive, ambitious, fair, effective and binding multi-lateral rules-based agreement under the UNFCCC at the 21st Conference of the Parties (COP21) in Paris. South Africa has submitted its intended nationally-determined contribution (INDC) on adaption and mitigation, as well as finance and investment requirements for both. South Africa's INDC was formulated in the context of, *inter alia*, the environmental rights set out in Section 24 of the Constitution, and its National Development Plan (NDP) (NPC, 2012), which provides a '2030 vision' to guide the country's sustainable development trajectory, where poverty is eliminated and inequalities are reduced by 2030 (INDC, 2015). Progress has been made in implementing climate-compatible sectoral plans, such as the integrated energy and electricity plans (IEP and IRP), industrial policy action plans (IPAP), and the new growth path (NGP). In order to speed up implementation of these policies and plans, South Africa is investing heavily in transforming its energy sector. The crux of the transition to a low-carbon energy sector is a complete transformation of the future energy mix, which is designed to replace an inefficient fleet of ageing coal-fired power plants with clean and high efficiency technology.

South Africa communicates, via its INDC that it will address adaptation through six goals:

- Goal 1: Develop a National Adaptation Plan as part of implementing the NCRP by 2020.
- Goal 2: Take into account climate-consideration national development, sub-national and sectoral policy framework, by 2020/2025.
- Goal 3: Build the necessary institutional capacity for climate-change response planning, by 2025/2030.
- Goal 4: Develop an early warning system for key climate adaptation sectors by 2025/2030, and report, as part of a National Adaptation Strategy, with rolling five-year implementation periods.
- Goal 5: Development of a vulnerability assessment and adaptation-needs framework by 2020.
- Goal 6: Communication of past investment in climate adaptation for international recognition.

South Africa's mitigation component of the INDC communicates a peak, plateau and decline GHG-emissions trajectory range, with emissions by 2025 and 2030 between 398 and 614 Mt CO_2e. This is the benchmark against which the efficacy of mitigation actions will be measured.

South Africa's support of the INDCs is required in the form of finance, technology and capacity-building. Some technologies that could assist South Africa in reducing emissions significantly have been identified to include:

- Energy efficient lighting;
- Clean Coal Technologies
- Variable speed drives and efficient motors;
- Energy efficient appliances;
- Solar water heaters;
- Hybrid electric vehicles;
- Solar PV;
- Wind power;
- Carbon Capture and Sequestration;
- Nuclear; and
- advanced biofuels.

3. Research Methodology

In this chapter, the qualitative content analysis approach is selected to answer the research questions. Two research questions are first introduced, followed by a justification for setting the scope of the investigation on the sustainable development goals 7 and 13. The theoretical description of the content analysis is provided together with a description of the strengths and weaknesses. Similar studies employing this technique are introduced to provide support for the selected method. The mechanisms for data collection are given, as well as a selection of companies that will be investigated within the study. The chapter concludes with the ethics procedures followed throughout the research.

3.1. Research Question

The literature review provided context of the Sustainable Development Goals, the South African coal mining industry and the governments stated position on Climate change and clean energy. This highlighted the dichotomy between South Africa's policies on clean energy and its continued reliance on a coal based energy system. Therefore, the following research questions are formulated to help achieve the objectives of the dissertation as stated in section 1.3:

1. Do companies operating in the South African coal mining industry have sufficient systems, procedures and controls to measure, report and demonstrate progress toward meeting the nationally determined targets of the Sustainable Development Goals?
2. Can sustainability reports of individual companies be combined to gauge the sustainability performance of the entire South African coal-mining sector?

3.2. Sustainable Development Goals

SDGs are designed to be an integrated and indivisible set of goals which provide a global framework for development that encompasses the economic, environmental and social aspects of sustainability. Although the interlinked and integrated nature of the SDGs is acknowledged, the specific interactions and interdependencies between SDGs is not explicit in the description of goals and their associated targets. Therefore, for the true potential of the SDGs to be unlocked, it is important to understand the interactions between specific SDGs to in relation to specific industries. In some instances these interdependencies may be synergistic or counterproductive. For example, achieving SDG 2 (Zero Hunger) may result in natural ecosystems being cleared for agriculture, thereby reducing SDG 15 (Life of land). These potential synergies or trade-offs are important to understand, as specific regions or industries may prioritise some goals over others, depending on their needs. This study will attempt to provide a practical methodology with which to analyse a system through the lens of the SDGs.

In the study, Sustainable Development Goals 7 (clean energy) and 13 (climate action) are used to analyse the South African coal sector in terms of their reporting on indicators and their overall strategy toward climate change and renewable energy. Sustainability performance data can provide a powerful tool for assessing an organisations' health and future prospects.

In utilising the framework of the SDGs to analyse a specific system, a problem arises due to the sheer scale of indicators and targets contained within the SDGs. Collecting data on 17 goals and 169 targets is inefficient and resource-intensive. This paper therefore adopts the approach of defining a system, the South African coal industry, and then defining the specific characteristics of the industry that it wishes to investigate. The appropriate SDGs are then selected to analyse the system. This allows for a richer investigation, and is more efficient for studying specific phenomena of a system. This methodology is summarised in Table 12 below.

Table 12: Scope of Investigation

System	South African coal sector
Characteristics under investigation	Reporting, energy efficiency, climate action strategy
SDG selection	7 (Clean energy), 13 (Climate action)

It is important to acknowledge the potential shortcomings of employing this method. The SDGs are promoted as an "integrated and indivisible whole"; therefore selecting a few goals while ignoring others may seem paradoxical. The reason the SDGs are described as integrated is the fact that some goals are inextricably linked to others. It is therefore important to understand the interactions between SDGs within specific contexts. Understanding the interactions between SDGs allows for the selection of those have a strong correlation with one another and the omission of those that do not.

The author relied on research conducted by the International Council for Science (ICS) in order to define the relationship between SDG 7 and SDG 13. A number of dimensions can be used to context.

UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

DEPARTMENT OF CHEMICAL ENGINEERING

DISSERTATION

The South African coal mining industry as a driver of green growth and a low carbon economy? A study on Sustainable Development Goals 7 & 13

Author:
Corey Beavon

A thesis submitted in partial fulfilment of the requirements for the degree of Master of Philosophy
Faculty of Engineering and the Built Environment in the Department of Chemical Engineering

ualise the assessment of specific synergies and trade-offs. These include directionality, place specific context dependencies, governance, technology and time-frame (Nilsson et al., 2017).

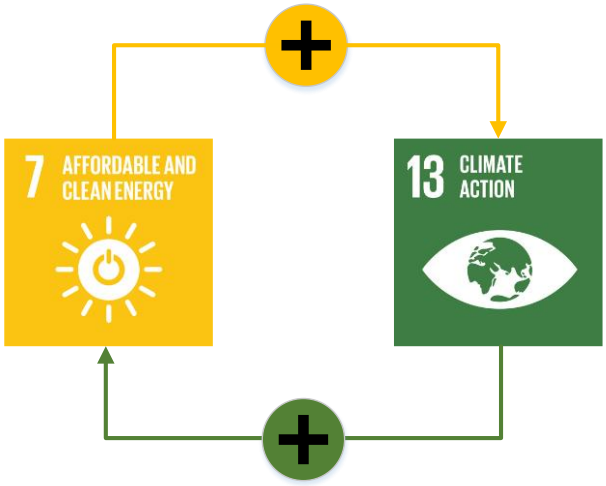


Figure 14: Positive feedback loop between SDG 7 & SDG 13 (source: Author)

The achievement of SDG 13 is strongly reliant of the success of SDG 7. If renewables are radically up-scaled and energy efficiency is improved, then greenhouse gas emissions will decrease. Conversely, SDG 13 will affect SDG 7 positively because, if climate change is integrated into national planning and policy, then investment and uptake in renewables will be far more likely. SDG 7 and SDG 13 therefore have a synergistic and bi-directional relationship.

3.3. Content Analysis

3.3.1. Supporting the chosen method

The author employs a content analysis to answer the research questions for the following reasons:

- It is the most commonly-used research technique employed to analyse ESG data found in companies' annual reports and sustainability reports (e.g. Guthrie & Mathews, 2007; Hackston & Milne, 1996; Gray, Kouhy & Lavers, 1995; Cowen, Ferreri & Parker, 1987). Content analysis has been applied to sustainability reports; it has been used to evaluate the level of disclosure of various aspects in annual reports of listed companies (Guthrie & Parker, 1990). These aspects can be social and environmental elements, such as water usage, human rights, etc. In addition, studies have often compared these elements with those of other comparative studies. According to Parker (2005), content analysis is the most-commonly used framework for collecting empirical evidence within social environmental accounting.

- Annual reports and sustainability reports are the standard format used by companies to publish information to stakeholders. These documents are often hundreds of pages long, the majority of the data being qualitative in the form of text. Therefore a method that reduces and classifies information into specific categories to analyse and compare companies, is required.

- A content analysis is flexible and may combine varying degrees of concept-driven and data-driven categories within one coding frame (Krippendorf, 2004). This makes it an ideal method by which analyse companies' performances.

3.3.2. Defining the method

Content analysis is a research technique for making repeatable and valid inferences from texts to the contexts of their use (Krippendorff, 2004). This involves codifying qualitative and quantified information into pre-defined categories in order to derive patterns in the presentation and reporting of information. The technique is particularly useful for extracting information which is not explicitly presented in a quantified and structured format, but is implicit in the information. The process is systematic in that it requires the reader to look at all the material available to answer the research question, following predetermine steps, and also requires assigning parts of the material to categories in the coding framework. The content analysis is systematic in order to avoid the mistake of drawing assumptions from the data. The method is systematic in that it requires a specific sequence of steps to be followed, regardless of the exact research question of the material. This often becomes an iterative procedure, with the coding frame being modified throughout the process. But the sequence of steps and the process remains consistent throughout. The method is also systematic in that it requires a coding; assigning segments of the material to the categories of the coding frame (Schreier, 2014). Furthermore, the three criteria for the data collected are that it should pass tests for objectivity, "systematic" and reliability (Krippendorff, 1980):

- Objectivity implies that an independent judge identifies the same categories as you do.
- Systematic requires clear, mutually-exclusive and all-covering categories and sub-categories. "Thereby, something should clearly end up within one, and only one, category, and this should be the same for anyone doing the analysis"(Gray et al., 1995).
- Reliability implies that the data is stable, reproducible and accurate (Krippendorff, 1980).

Within sustainability reporting research there are two main forms of combinations: firstly, content analysis of annual reports combined with semi-structured interviews; secondly, content analysis of several sets of information and other research methods, such as scoring methodology (Guthrie & Abeysekera, 2006). For the purpose of this study, content analysis, employing a scoring methodology, is employed in order to evaluate the sustainability performance of each company.

3.3.3. Research Design

The content analysis involved reading the annual reports of each company, and coding the information contained therein in accordance with a selected framework of indicators. The chosen framework was derived from the SDGs in line with current sustainability reporting techniques.

According to Hsieh & Shannon (2005), there are seven steps to conducting a content analysis:

1. Formulating the research questions
2. Selecting the sample and unit(s) of analysis
3. Defining the categories
4. Outlining the coding process.
5. Implementing the coding process

6. Determining trustworthiness
7. Analysing and representing results

These steps are followed in the research design of the dissertation, and are detailed at length throughout the remainder of the chapter.

3.4. Critique of methodology

One of the limitations regarding content analysis has been the focus on quantity of disclosure and not on the quality. Frequently, scoring systems give points for merely referring to certain keywords, rather than substantiating their disclosures qualitatively. Constructing an index that considers quality and is not just binary can however overcome such issues (Guthrie & Abeysekera, 2006).

A comparative analysis between the selected companies is difficult since the scope and activities of each differ drastically. For example, Anglo American and Glencore are large multi-national companies that operating across many countries and have large resource portfolios, while Exxaro operates predominantly in coal and Sasol is a unique business operating within the Energy and Natural Resources and the Mining and Metals sectors. It would be ideal to compare data gathered from each company's coal business units; however, this is not possible based on the publicly available data. Some companies do report based on commodity and geographical region while others report as a single entity. It is important to keep this information in mind when conducting a comparative analysis. The comparison gives an indication of companies' systems and controls for sustainability risk identification and management within the broader extractives sector.

While the methodology proved to be useful and practical for the purposes of this study, there were issues in assigning and scoring data. This was due to the subjective nature of the coding process. This created an opportunity for potential errors in judgment, which were exacerbated by the fact that sustainability reports are excessively lengthy and the process is iterative and time-consuming.

3.5. Sampling

CSE-reporting research has also revealed that larger companies tend to disclose more information than have smaller companies. It is suggested that larger companies are under more public scrutiny than smaller companies (Cowen, Ferreri & Parker, 1987) and are therefore under greater pressure to demonstrate that they conduct their activities in accordance with social values. Many studies in the CSE-reporting literature have provided evidence to support organisational size as a factor influencing environmental disclosure practices (Patten, 1992; Cowen, Ferrari & Parker, 1987; Trotman & Bradley, 1981). Based on this research, the author decided to select the largest companies, in terms of coal production, operating in the South African coal sector. The monopolistic nature of the South African coal sector means that five companies account for over 85% of South African coal production; these companies were therefore selected as the sample size of the investigation. They are: Anglo-American, Glencore, Exxaro, Sasol and South32.

3.6. Data Collection

After selecting the sample size and defining the measures used to select the individual companies, the data collection was done by gathering each company's published reports for the year of 2016. This included visiting the website of each company and downloading the respective available reports. The report-publishing format of each company differed, and the number of sustainability reports also varied. Reports were gathered through the use of generic search engines such as Google, and sustainability databases such as the GRI.

The author placed a time limit of two hours for searching the relevant reports, after which it was assumed that they were not available publicly, this is in line with the protocol outlined by Rikhardsson *et al*. (2002).

3.7. Indicator development

A final indicator list employed in the study drew on indicators and insights from three well-recognised reporting initiatives:

- The Sustainable Development Goals
- The Global Reporting Initiative
- The Carbon Disclosure Project

As far as possible, the evaluation method should be orientated toward established valuation procedures from other studies. This appears logical and necessary, since those procedures are based on the guidelines laid down by the GRI, which are used by most companies as a reference for developing their own reporting procedures. Relying on indicators previously defined allows the research to be compared with reporting initiatives, and hence the reliability of the accounting mechanism can be assured. All indicators used have been previously identified, and used in the aforementioned initiatives. This makes sifting through company reports more efficient, as many of the selected indicators have already been reported previously.

The indicators and targets prescribed by SDG 7 and SDG 13 will be mapped to GRI indicators. Some of the indicators link directly to specific GRI indicators while others apply more loosely. GRI is used as a frame of reference as it is the most widely-used reporting initiative, and companies are required by law to report in GRI standards if they are listed on the Johannesburg Stock Exchange (JSE). The purpose of the analysis is to achieve an overall score for coal companies being rated in line with SDG 7 and SDG 13.

Table 13: Indicator list for Sustainable Development Goal 7

Nr	Indicator Description	SDG
1	Total Direct Energy Consumption (GJ)	7
2	Total Indirect Energy Consumption (GJ)	
3	Total Energy Intensity	
4	Target Reduction in Electricity Intensity	

5	Target Reduction in Energy Intensity	
6	Reductions in Energy requirements of products and services	
7	Production or use of renewable energy	
8	Does the company have a renewable energy consumption and/or production target?	
9	Percentage of your total operational spend on energy	
10	Total Carbon Emissions	13
11	Total Carbon Emissions include the following mix (Scopes 1)	
12	Total Carbon Emissions include the following mix (Scopes 2)	
13	Total Carbon Emissions include the following mix (Scopes 3)	
14	Carbon emissions intensity	
15	Target Reduction in GHG emissions	
16	Climate change integrated into Business strategy	
17	Risks and opportunities posed by climate change that have the potential to generate substantive changes in operations, revenue or expenditure	
18	Participation in emission-trading schemes	
19	Allocation of CO_2 emissions allowance or equivalent broken down by carbon-trading framework	
20	Expenditure on treatment of emissions	
21	Highest level of direct responsibility for climate change within the organisation	
22	Percentage of total operation spend on low carbon products/technologies	

3.8. Developing a scoring system

The scoring process was conducted by gathering all relevant information from the company being analysed. This included website information, annual reports, sustainability reports and other supplementary information that could be found in the public domain. Each indicator was scored before the author proceeded to the next indicator. This was done by reading through the data and grouping relevant information, which was re-scrutinised before being scored. The computer search function was also employed to locate keywords and GRI indicators to ensure that no information was overlooked. Once this process was completed it was re-assessed to ensure all issues and scores were consistent across all the companies assessed.

A scoring system builds on the coding framework by allocating a quantitative score to a specific indicator rather than merely providing a disclosure index. In this investigation the author has adopted a scoring system in the range of 0-2. The range of 0-2 was selected because of the difficulty in differentiating between a score of 3 and 2. Fewer ranges decrease the probability of incorrectly scoring a company's response to a specific indicator. The definition of each scoring category follows:

- 0 - No meaningful information concerning the indicator, or not mentioned at all, or not located by the author.
- 1 - A partial response offering some expectations regarding the indicator's anticipations but not enough to cover all the aspects or fully understand the management of the indicator.
- 2 - A reasonable response concerning the indicator.

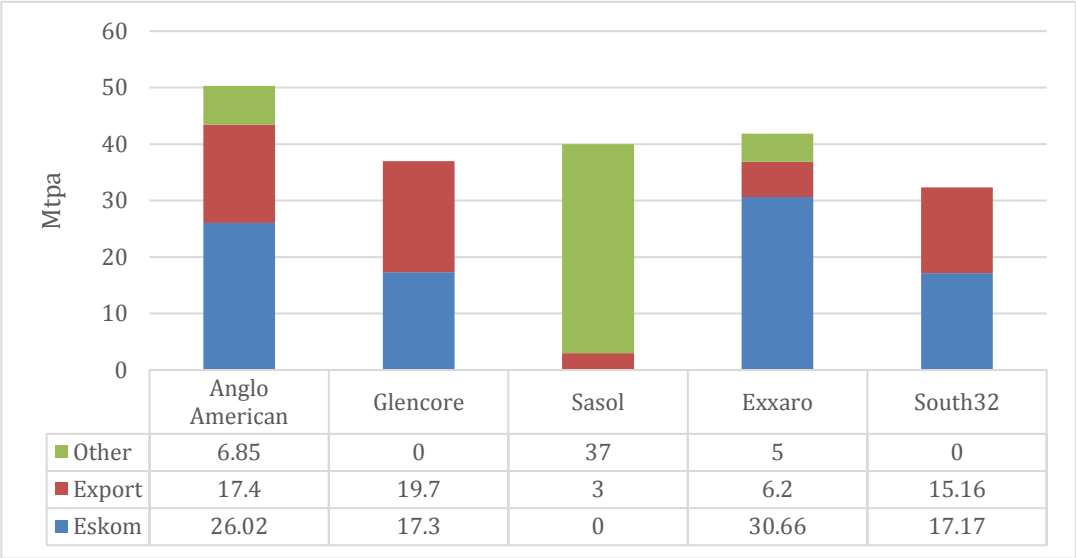
3.9. Research Ethics

To ensure that the research would comply with ethical practices, the proposal was subjected to a review by the Engineering and Built Environment Ethics in Research Committee (EiRC) before any data collection. The EiRC granted approval. Ethical risks considered were the concerns of misrepresenting a company's stance on climate change.

4. Results and Discussion

4.1. Company Coal Production in South Africa

The largest coal producers in the South African market are determined through 2016 coal tonnage produced. The producers are Anglo American, Glencore, Sasol, Exxaro and South32. The tonnage of coal produced is depicted in Figure 15.



	Anglo American	Glencore	Sasol	Exxaro	South32
Other	6.85	0	37	5	0
Export	17.4	19.7	3	6.2	15.16
Eskom	26.02	17.3	0	30.66	17.17

Figure 15: Production of coal by company (Annual reports, 2016)

Figure 15 shows that Anglo American, is the largest coal producer at 50 Mtpa. Exxaro and Sasol are the lowest exporters of coal, most of their coal predominantly used for domestic operations. Sasol uses over 90% of its coal to run its coal-to-liquid petrochemical plants, while Exxaro supplies approximately 75% of its coal to the domestic utility Eskom. This places Exxaro at risk, as it is highly dependent on the state utility for the sale of its product. Overall, the five companies produced approximately 200 Mtpa of coal in 2016.

Once the largest operators in the South African coal market are identified, the reports published by each company are collected and analysed in accordance to with indicator index outlined in the Methodology.

4.2. Reports used in Analysis

The reports and data used in the research is presented in the table below. The table below indicates what format the respective companies report their data in.

Table 14: Reports per company used in analysis (2016)

	Integrated annual Report	Sustainability Report	Consolidated Financial Statements	CDP	GRI Index	Other	Web support
Exxaro	✓	✓	✓	✓	✓	✓	✓
Anglo	✓	✓	✓	✓	✓	✓	✓
Glencore	✓	✓	✓	✓	✓	✓	✓
Sasol	✓	✓	✓	✓	✓	✓	✓
South32	✓	✓	✓	✓	✓	✓	✓

In 2016, all five mining companies produced integrated annual reports together with independent sustainability reports. In addition, each report contained GRI indices which cross-referenced GRI indicators to specific pages. It was also possible to access each company's CDP report through registration on the CDP website. It should be noted that Sasol was the only company that made its CDP report easily accessible via its website, and negating the effort of using a third party to access it. All the companies maintain corporate websites, which contain additional information on their social and environmental operations as well as downloadable pdf version of their published reports for 2016. All of the companies stated that they were reporting in accordance with GRI guideline, and had sought external assurance for certain indicators.

The table below outlines the assurer and assurance type employed by each company investigated. Companies typically get external assurance to validate and asses their sustainability data. The table also indicates whether the company elected to use the GRI's core or comprehensive application level and what version of the GRI framework is used. Finally the table includes whether the companies' reports included information on the Sustainable Development Goals (SDGs) and/or the Carbon Disclosure Project (CDP). If a company reported on an aspect it received a tick and if it did not it received a cross.

Table 15: Company report information

Company	Assured	Assurances	Report Type	Application Level	Sector	SDGs	CDP
Exxaro	PwC	AA1000AS	GRI-G4	Core	Mining	✓	✓
Anglo	PwC	ISAE3000	GRI-G4	Core	Mining	✓	✓
Glencore	Deloitte	ISAE3000	GRI-G4	Core	Mining	✕	✓
Sasol	PwC	ISAE3000	GRI-G4	Core	Chemicals	✓	✓
South32	KPMG	ISAE3000	GRI-G4	Core	Mining	✓	✕

Table 16: Indicator responses per company

	Nr	Indicator Description	Exxaro	Anglo	Glencore	Sasol	South 32
SDG 7	1	Total direct energy consumption					
	2	Total indirect energy consumption					
	3	Total energy intensity					
	4	Target reduction in electricity intensity					
	5	Target reduction in energy intensity					
	6	Reductions in energy requirements of products and services					
	7	Does the company produce or utilise renewable energy?					
	8	Does the company have a renewable energy consumption and/or production target?					
	9	What percentage of the company's total operational financial expenditure was on energy?					
SDG 13	10	Total carbon emissions					
	11	Total carbon emissions (Scopes 1)					
	12	Total carbon emissions (Scopes 2)					
	13	Total carbon emissions (Scopes 3)					
	14	Carbon-emissions intensity					
	15	Target: reduction in carbon emission intensity					
	16	Climate change integrated into business strategy					
	17	Risks and opportunities posed by climate change that have potential to generate substantive changes in operational or revenue expenditure					
	18	Does the company participate in emission-trading schemes?					
	19	Does the company allocate CO_2e emissions allowance within a carbon-trading framework?					
	20	Expenditure on treatment of emissions					
	21	Highest level of direct responsibility for climate change within the organisation					
	22	Percentage of total operation spent on low-carbon products/technologies					
Score			77%	70%	84%	82%	61%

The methodology in calculating scores and detailed definitions of indicators is found in Appendix A.
For indicators 7, 8, 18, 19, the scoring depends on the answer and not the disclosure of the indicator.

Green = 2 points, Yellow= 1 point, red = 0 points. (Companies scored out of a total possible score of 44)

4.3. Energy and emissions analyses of the companies

After scoring each company against the indicator table, an analysis of the individual use of emissions and energy was conducted. This involved analysing each company's consumption and intensity of energy, as well as its total carbon-emissions and carbon-emission intensity. The quantitative comparison between these companies is difficult due to the fact that they are of different sizes and produce a range of different products, however it provides insight as to the systems the companies have in place to measure specific data and whether they are focused on measuring data that is significant to SDG 7 and 13.

The figure below compares each companies total energy use and does not control for region or activity. Therefore the scope and nature of each company's business activities are important to consider in comparing these values.

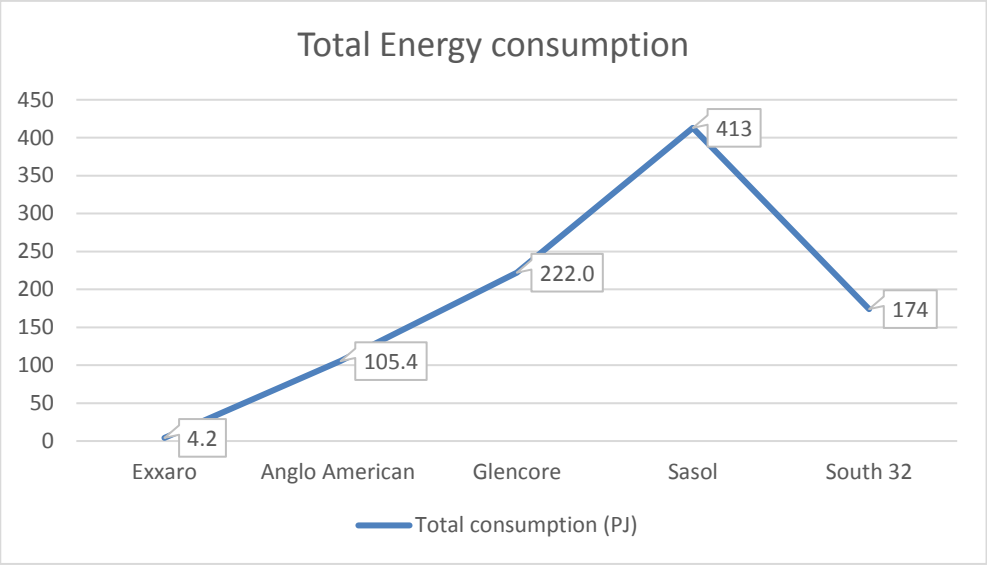


Figure 16: Total energy consumption (Annual Reports, 2017)

Sasol is the highest consumer of energy at 413 PJ, with Exxaro the lowest at 4.2 PJ. This highlights the vast differences in operation of the companies investigated. Sasol produces a large amount of its own electricity, and thus has a high consumption of direct energy in the form of coal, diesel and other petroleum products. This is fairly typical of companies in the energy and natural resources sector; while Exxaro, at the other end of the scale, is predominantly a coal-mining operation with a consequently lower consumption of energy. It is important to note that reporting total energy consumption is not useful without understanding the nature and scale of the operations of each company; therefore intensity figures for energy allow meaningful comparability between companies within similar industries.

While not possible to compare total carbon emission in tons, given the wide range of activities of each company, the appropriate metric with which to compare performance between companies is emission intensity: carbon emissions per PHW, or carbon emission per unit revenue. Efficiency is calculated using person-hours worked (PHW) and/or revenue. These two metrics provide comparable intensities with which to benchmark each company's performance. PHW is a crucial

indicator that was not reported by all the companies reviewed. The author therefore calculated a PHW for each, based on the total work force reported, and used an average of 1 824 working hours per annum per employee.

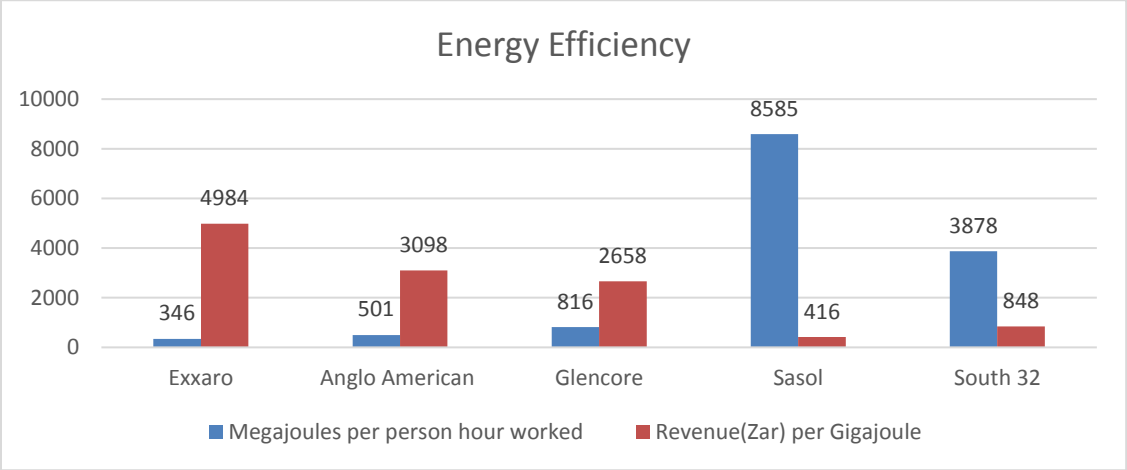


Figure 17: Energy Intensity (Annual Reports & CDP, 2017)

The two metrics used in Figure 17 provide insight as to how efficient the companies are with their energy use. It is preferable to have a lower mega joule per PHW ratio and a higher revenue per gigajoule ratio. Based on both metrics, this makes Exxaro the highest performer and Sasol the lowest.

Figure 18 indicates carbon emissions for scope 1 and 2, for each company including all operations. Companies typically report carbon emission in three different categories. Scope 1 are direct GHG emissions, scope 2 is indirect GHG emissions from energy use, while scope 3 is other indirect GHG emissions.

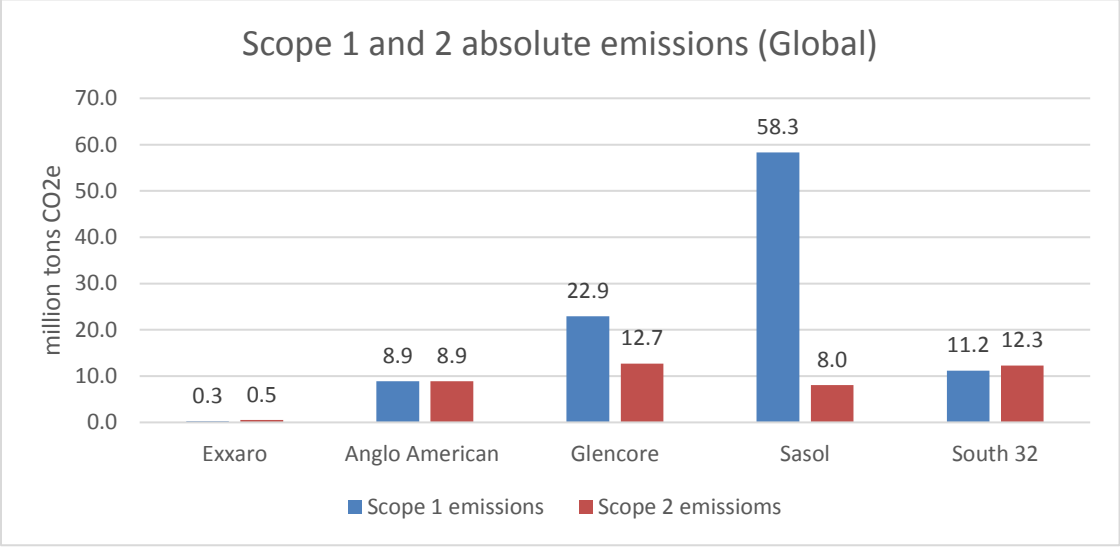


Figure 18: Carbon emissions (CDP, 2017)

Figure 19 compares each companies' carbon emission intensities to determine the amount of carbon each company emits in comparison to their size of their employee force. The emission intensity indicator reveals that Sasol and South32 are the highest emitters per PHW worked, while Exxaro has the lowest emission intensity per PHW. A company may have a high absolute emission value but a low intensity emission value and therefore it is important to compare companies using intensity values.

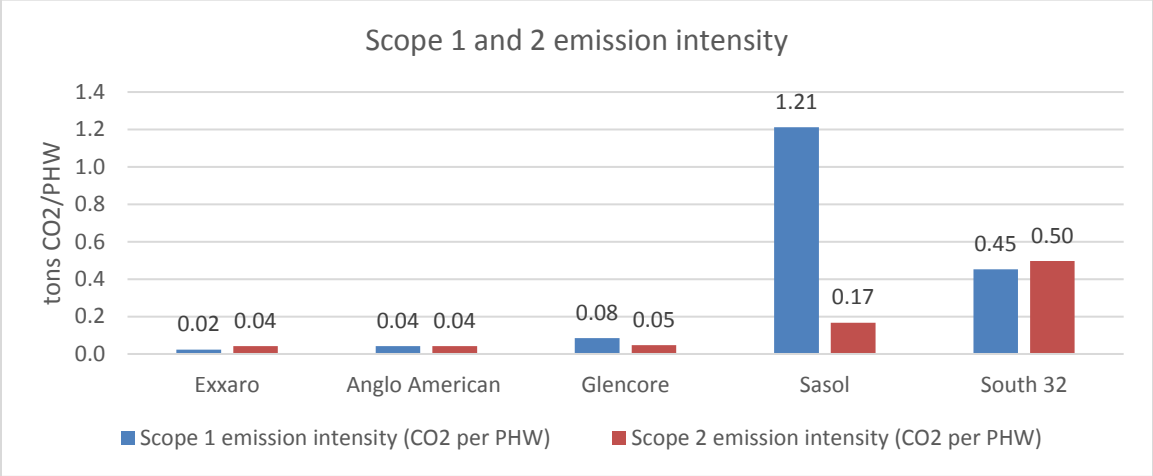


Figure 19: Emission intensity of Scope 1 and 2 (CDP, 2017)

Figure 20 provides an insight into the carbon emissions each company produces by virtue of its operational activities, as well as emissions from the combustion of its sold products. This figure highlights the difference between each company in terms of energy use versus the combustion of each company's fossil fuels products.

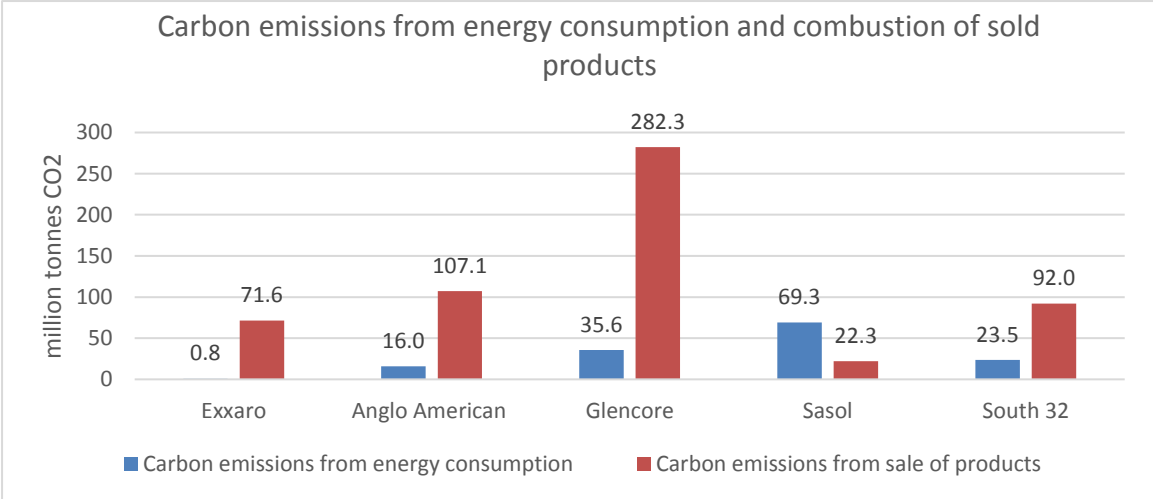


Figure 20: Carbon emissions from energy consumption and sale of fossil fuel products (CDP, 2017)

Figure 20 highlights two aspects of the companies analysed. It assesses the emissions based on each companies operational energy use and emissions based on the combustion of their sold fossil

fuels. This is significant to analyse as some companies state their intention to reduce energy use or introduce renewable energy on-site but do not address the responsibility of their carbon intensive products that will end up in the atmosphere once combusted. As shown in the figure the carbon emissions resulting from the sale of carbon based products far outweighs the emissions from the companies' operational activities.

4.4. Company Reviews

4.4.1. Glencore

Glencore is an Anglo-Swiss multinational commodity trading and mining company employing approximately 150 000 people. Glencore is one of the largest integrated producers and marketers of commodities, with operations in over 50 countries comprising of over 150 mining, metallurgical, oil and agricultural assets. The company is structured into three main business segments; metals and minerals, energy products and agricultural products. The current company was created through a merger of Glencore with Xstrata on 2nd of May 2013. This merger made the company a dominant player in the South African coal market as it gained significant coal assets from Xstrata (Glencore, 2016). The company is now the largest exporter of coal in South Africa and an important supplier to Eskom. In 2015 Glencore produced 37 Mtpa of coal with approximately half being sold to Eskom and the remainder being exported. Glencore are a leading producer and exporter of bituminous thermal coal and a significant producer of both premium hard and premium semi-soft coking coal. The company supplies thermal coal to customers from a wide range of industries and locations, including major utilities across three continents. Glencore is a significant producer of energy products and also a significant consumer of energy. Energy is a key input and cost to the business and a material source of carbon emissions.

The top scorer is Glencore with 84%. Glencore did not disclose on two indicators, namely, "Target reduction in electricity intensity" and "Target reduction in energy intensity". The group did not disclose a company-wide target for a reduction in electricity, or a reduction target in energy intensity. While the company scores a partial response in "Expenditure on treatment of emissions", it does not disclose a total expenditure on emissions but does disclose expenditure on separate emission initiatives. Glencore provided stakeholders with multiple supplementary reports. It is the only company that maps their activities to the separate sustainable development goals in its SDG report. Glencore is the company that implemented the SDGs most overtly into its operating culture, linking its KPIs to specific SDGs, Glencore's sustainability report is also structured in the format of the SDGs. The group also produced a separate climate change report to accompany the required integrated annual report.

Glencore reported extensively on separate business units, including information of geographical locations and a list of operations by region. Reporting in this manner allows for information to be aggregated and compared, based on either commodity or location, which is useful in comparison with data of other mining companies. The Glencore report also included a three-year timeline on environmental indicators, which allowed the reader to compare their performance over that time-frame.

4.4.2. Sasol

Sasol is an integrated chemicals and energy company based in South Africa. The company was formed in the 1950's and was the first company to use coal to liquid (CTL) technology to develop a range of petrochemical products (Molwatt, 2013). Sasol develops and commercialises synthetic fuel technology as well as build and operate facilities to produce liquid fuels, chemicals and electricity (Sasol, 2016). Sasol employs approximately 30 000 people and is the largest corporate taxpayer in South Africa (Sasol, 2016).

The company produces 40 million tons per year of coal form one of the largest underground mining complexes in the world and exports approximately 3 million tons of coal per year (Sasol, 2016). The company uses nearly all of its 40 million tons of mined coal to run its coal-to-liquid plants. Most of the coal is used as gasification feedstock however some is used to generate electricity. Most of Sasol's mines are nearing their end of life and thus the company is investing nearly R14 Billion to replace 60% of its operations in Secunda by 2020. The renovations will make the underground complex in Secunda one of the largest in the world and will ensure 42 million tons a year of coal production for Sasol's synfuel plant (Sasol, 2016).This makes Sasol one of South Africa's largest investors in capital projects, skills development and technological research and development.

Sasol scored 82%, it failed to report on only one indicator, "Target reduction in electricity intensity", while responding negatively on two others, "does the company produce or use renewable energy?" and "does the company have a renewable energy consumption and/or production target?" Beyond these three indicators the company produced an excellent integrated annual report and sustainability report. Sasol is widely regarded as a leader in sustainability reporting in South Africa, its reporting style representing a degree of maturity. It produced a concise and succinct report that contained quality quantitative data about their operations.. Group-wide data were accompanied by significant information per division. The report also included a six-year timeline on environmental indicators, allowing the reader to draw comparisons. The company does not over-populate its report with qualitative information, instead providing quantitative and informative and comprehensible data for the reader.

4.4.3. Exxaro

Exxaro is a South African-based diversified resources company focusing primarily on production of coal. It is one of the largest broad-based black-owned and managed JSE listed companies. Formed in 2006 out of the formerly state-run company Iscor, Exxaro is central to the South African energy system, being the largest domestic coal supplier with long-term commercial contracts. Exxaro owns several coal mines that produce thermal and coking coal, some mines producing solely for Eskom power plants. Most of Exxaro's coal is supplied to Eskom, making the company highly dependent on the state utility (Exxaro annual report, 2016). While Exxaro's asset portfolio is predominantly coal, it also has investments in iron ore, pigment manufacturing, residual base metals and renewable energy. In 2016, the company produced 42.8 Mtpa of coal and exported approximately 7.9 Mtpa. Exxaro has the largest coal reserves of any company in South Africa, although most of the resources (87%) are in the Waterberg region (Exxaro, 2015), where further infrastructure is required in order start full scale production.

Exxaro scored 77%. While it did not respond to all the indicators, it nevertheless produced an annual integrated report and supplementary sustainability report of high quality. Exxaro's quantitative data is displayed in a logical and transparent fashion. The company provides detailed environmental performance data, including that of emissions and energy consumption, broken down by mining operation. This has proved to be the most detailed overview of specific business units in any of the companies under review.

4.4.4. Anglo American

Anglo American plc is a multinational mining company with approximately 115 000 employees. It is the world's largest producer of platinum, with around 40% of world output, as well as being a major producer of diamonds, copper, nickel, iron ore and metallurgical and thermal coal (Anglo American, 2015). The company operates in Africa, Europe, South and North America, Australia and Asia. The headquarters are in London, United Kingdom and is are listed on the London and Johannesburg stock exchanges (Anglo American, 2016).Anglo American is the largest thermal coal producer in South Africa and is one of the largest diversified mining groups in the world. It has coal divisions in South Africa, Australia, South America and Canada. Matters relating to climate change and energy are included in each quarterly report to the Committee, and also feature periodically as stand-alone items on the agenda. Matters discussed by the Committee in 2016 are disclosed on page 18 of the 2016 Anglo American Sustainability Report. The Chair of the Sustainability Committee provides a summary of the Committee's discussions at the Board, which addresses the most material issues raised by the Committee. The CEO performance scorecard and report to the Board also include performance indicators on energy and GHG emissions.

Anglo American scored 70%. The company also reports on separate business units, providing a detailed geographical representation of its operations. Reporting by separate business units allows the reader to determine which units are most energy-intensive or most profitable. The majority of Anglo's quantitative data disclosures include four years of historical data, allowing for an assessment of its performance over time.

4.4.5. South32

South32 is a globally diversified metals and mining company headquartered in Perth, with approximately 14 000 employees. South32 mines and produces bauxite, alumina, aluminium, energy and metallurgical coal, manganese, nickel, silver, lead and zinc in Australia, Southern Africa and South America. South32 businesses include open pit and underground mines, refineries and smelters. The company also operates associated infrastructure such as power stations, railways and ports.South32 was formed out of BHP Billiton in 2015 and is now the third largest coal exporter and the fifth largest domestic coal supplier in the South African coal industry. South32 produced 31.68 Mtpa of coal in the financial year of 2016, of which 17.17 Mtpa was used for domestic energy market and the remainder was exported (South32, 2016).

South32 had the lowest score, achieving 61%. This low score is due partly to the company having only recently started to produce CDP reports. South32 is therefore is still developing its reporting systems regarding to energy and carbon emissions. The company separates its quantitative disclosures by two regions, namely, Africa and Australia. Other disclosures are also broken down by countries it operates in and by commodities. South32 also released a separate report covering

how it defines materiality. The company has an effective process for defining its impact boundary of each indicator reported, by including a boundary-scope in its GRI Navigator report.

4.5. Summary of risks and opportunities of climate change

4.5.1. Risks

The companies' investigated listed a range of common risks posed by climate change. A primary risk is that the use of coal may become restricted in a green economy. Public behaviour and growing concerns over environmental degradation have placed an increased reputational risk on the companies that are large energy users and producers of fossil fuels. In addition, there is an increased risk that consumers or investors may avoid buying or investing in products which damage the environment. Anglo American and South32 have stated publicly that they plan to discontinue pull their coal energy business entities in South Africa (Mckay, 2017). Both companies have highlighted the political uncertainty in South Africa, as well as their willingness to reduce the number of fossil fuel products in their portfolios. While there remain concerns over the reputational risk involved in coal production and the financial implications of coal tax and budgets, most companies are confident that coal will remain a major part of the overall energy mix in years to come, particularly in South Africa where coal is the primary source of energy generation. Glencore states that it expects to invest in over 107 GW, or more than 220 new coal-fired units before 2033, and that the seaborne coal trade will grow by 290 million tons in that period. The company has supported these views by increasing its ownership of major coal operations in 2017 (Riseborough, 2017).

A summary of the risks posed by climate change explicitly stated by companies includes that (CDP Reports, 2017):

- Climate change regulations and policies pose significant business risks, encompassing carbon taxes or budgets which could increase the cost of operations.
- The demand for products will change in a carbon-restricted future.
- The physical and social impacts of a changing climate, such as water scarcity and more frequent extreme weather events, may affect the operations and their host communities.
- There will reputational risks posed by the rise of the anti-mining and anti-fossil fuel campaign.
- Developments of the Paris Agreement will place greater emphasis on the private sector to adjust its operations in line with commitments made by national governments.

4.5.2. Opportunities

Global rhetoric, policy interventions and consumer behaviour are driving companies to improve their reputation and performance regarding energy and climate change. The financial risk imposed by carbon tax and increasing regulations on emissions are forcing companies to improve their efficiency and reduce emissions. These risks have also created opportunities as companies turn to renewable energy, low-carbon technologies and investment in strategic minerals for a low-carbon economy. Exxaro and Anglo American have, for example, led the way by taking advantage of the opportunity created by South Africa's Integrated Resource Plan for electricity. The mining industry in South Africa is experiencing a niche shift into renewable energy production for the national grid, not restricted for powering mining operations. Of interest to the author will

be whether companies will become integrated more vertically as opportunities to enter the energy production sector arise specifically in South Africa; three of the five investigated having stated their clear intent to invest in minerals that will rise in demand during the transition to a low-carbon economy.

4.6. Coal Industry Position on the Carbon Tax

The South African Government has made significant progress toward the development of policy and legal instruments which enable the measuring, reporting and verification of GHG emissions. This work has resulted in the draft Carbon Tax Regulations and National Pollution Prevention Plan Regulations, with the latter being developed under the National Environmental Management: Air Quality Act, 2004. A domestic carbon tax is envisaged for implementation by mid-2019. It is anticipated that a revised carbon tax bill will be gazetted by mid-2018. The November 2015 draft bill outlined the following proposed elements of a South African carbon tax:

- Rate of tax: the tax is anticipated to be levied at R120 per ton of CO_2.
- Scope and coverage: it is expected that a company's carbon tax liability will be limited to its Scope 1 emissions. However, the electricity sector will also be taxed, and is very likely to pass the cost on to the consumer, although proposals have been made to structure the tax in such a way as to keep the electricity sector neutral.
- Basic free allowances: businesses across certain sectors will be given allowances up to 60% of their annual Scope 1 emissions. These free allowances will accrue to industry until 2020, after which the threshold will be reduced gradually.
- The use of offsets to potentially lower the total cost of compliance by 5-10% has now been established.

The table below highlight each company's stance on the carbon tax in South Africa. It is difficult to come to a definitive conclusion on what stance a company takes as some contradicting information and statements are found.

Table 17: Companies' stance on the carbon tax policy in South Africa (CDP, 2017)

Company	Position on carbon Tax Policy
Exxaro	Supports the policy with major exceptions
Anglo	No statement
Glencore	Opposes the policy
Sasol	Opposes the policy
South32	Supports policy with minor exceptions

Most of the companies state in their reports that they would support 'appropriate' carbon pricing and budgeting; however, they have raised concerns over the South African carbon tax in its current format. The companies fear that the tax will reduce global competiveness and have a negative impact on energy-intensive industries. Exxaro states that implementing a new carbon pricing regime, which has unequal carbon prices for different industries, could lead to a transfer of production capacity (and jobs, investment, tax revenue and other impacts of productive activity) from a jurisdiction with higher carbon prices to one with lower or no carbon prices in

place. Other companies also cite the lack of a level playing-field possibly leading to negative financial impact on the industry. Furthermore, Sasol states that the carbon tax is being implemented together with a carbon budget in a misaligned manner, and out of sync with the prescribed mitigation approach for the country. Sasol remains opposed to the imposition of a carbon tax in South Africa due to its developmental status and a lack of lower carbon energy alternatives. The companies are also engaged with government regarding the design of the policy through organisations such as BUSA, ITTCC and COM. These organisations serve as a bridge between the private sector and government, expressing major concerns over the tax. Table 19 shows which companies are members of which organisations.

Table 18: Trade associations with which the companies are engaged (CDP, 2017)

Company	ICMM	BUSA	COM	ITTCC
Exxaro	✓	✓	✓	✓
Anglo American	✓	✕	✓	✓
Glencore	✓	✓	✓	✕
Sasol	✕	✓	✓	✓
South32	✓	✕	✓	✓

The trade associations and their roles are given below:

- Industry Task Team on Climate Change (ITTCC), whose role is to undertake technical, fact-based studies to ensure that South Africa's policies on climate change are based on the best information and best practice.
- International Council on Mining and Metals (ICMM), which was founded in 2001 to improve sustainable development performance in the mining and metals industry.
- Minerals Council of South Arica (MinCoSA) which seeks to ensure that environmental issues are addressed in a manner that enhances members' contributions to sustainable development, and ensures that risks to the viability of the mining industry are identified and managed.
- Business Unity South Africa (BUSA), is a voluntary coalition of South African and multi-national companies working towards sustainable growth and development in South Africa. The organisation recognises the implications of climate change and acts as an interface between government and industry.

5. Conclusions and Recommendations

At the time of writing this dissertation the UN's Sustainable Development Goals (SDGs) had been approved for approximately two years. The research presented here investigates whether and how the South African coal industry had responded to the SDGs, specifically to Sustainable Development Goals 7 (Clean energy) and 13 (Climate Action), in their 2016 annual reports. Coal-based energy provision is antagonistic to both these goals and South Africa's heavy reliance on coal has been recognised as needing to be overcome by a transition to a green economy (NDP). The objective of the research, as stated in chapter 1, was to provide a practical methodology with which to analyse an industrial sector through the lens of the SDGs and to provide insights into the strategies of companies with significant coal assets and determine whether they are making demonstrable progress in contributing toward meeting the Sustainable Development Goals.

This concluding chapter will outline the achievements of the stated objectives, answer the research questions and finally provide recommendations for further research and for improving industry practice.

5.1. Achievements of Objectives

To carry out the analysis, an SDG indicator framework was compiled from the most relevant indicators used in other well recognised initiatives such as the Global Reporting Initiative (GRI) and the Carbon Disclosure Project (CDP). The indicator framework consisted of 22 indicators and each of the major companies operating in the South African coal sector was scored against the indicators, receiving a score of 0, 1 or 2 for each indicator, depending on the quality of data. The analysis revealed that all five companies (Exxaro, Sasol, Anglo American, Glencore and South32) in 2016 reported on more than 60% of the 22 indicators, although the quality of the data varied significantly. It can be stated that all the companies investigated have sufficient systems in place to report and measure on certain key indicators such as energy use and total carbon emissions. While not possible to come to a definitive conclusion on the level of sustainability performance of companies by assessing their responses to the indicators, it provides insight into the systems in place to measure and report on environmental indicators, and shows the level of commitment which companies have toward sustainable development. Companies that report on indicators are deemed to have appropriate procedures and systems in place to measure and report on Sustainable Development Goals. While merely reporting on SDGs doesn't necessarily translate into sustainable operation or increased business revenue, there does appear to be a greater awareness of opportunities and risks by companies who report. This could place companies who measure, monitor and report their data, in a strategic position to identify and mitigate potential material risks. It is not necessarily the quantitative performance of indicators that is of importance, but rather the fact that companies are measuring and reporting on indicators and have an understanding of how to respond to environmental challenges.

The top scoring company, based on 22 indicators, was Glenore (84%) followed closely by Sasol (82%) and Exxaro (77%), whilst Anglo American (70%) and South32 (61%) did not score quite as well against the developed framework. Having a good reporting culture does not necessarily translate to a sustainable business operation and therefore commitment to the UN's Sustainable

Development Goals does not necessarily reflect on the indicator score. This is due to the fact that companies may be doing great work that they do not report on or they simply do not report data in the correct format.

The company with the most sophisticated reporting structure as evidenced by their top score is Glencore. The company linked the SDGs to their key performance indicators and compiled well-structured reports with relevant information. Only Glencore formatted their sustainability report in line with the structure of the SDGs and linked their KPIs to specific SDGs, while most companies merely mentioned the SDGs on a superficial level. However it should be stated that many of the initiatives the companies are engaged in do link to the Sustainable Development Goals such as the Carbon Disclosure Project. Therefore not reporting in line with the SDGs doesn't necessarily mean that a company is not sustainable.

Exxaro should also be mentioned for their venture into renewable energy as the company appears primed to play significant role in the green energy market in South Africa, already in 2016 having two fully-fledged wind farms, with a combined estimated capacity of 230 MW. This equates to roughly 5 500 000 MWh per year. however this makes up less than 1% of Exxaro's potential power produced from burning its yearly coal production in coal-fired power plants.

5.2. Answers to research questions

5.2.1. Question 1

Do companies operating in the South African coal mining industry have sufficient systems, procedures and controls to measure, report and demonstrate progress toward meeting the nationally determined targets of the Sustainable Development Goals?

All five companies stated their commitment to the Paris Climate Agreement and the associated Intended Nationally Determined Contributions (INDCs), as well as to the Sustainable Development Goals. Glencore directly linked its key performance indicators to specific SDGs while stating that the INDCs are not sufficiently aggressive to reach the goals outlined in the Paris Climate Agreement. It was found that reporting with regard to GHG emissions and energy consumption is often done in absolute values rather than with efficiency or intensity ratios. This makes the comparability of companies difficult, as they vary in their scope and scale of operation. It also allows companies to appear to have reduced emissions or consumption when, in actual fact, they may have closed down some of their operations. The companies investigated were found to have sophisticated climate-action plans, one company (Exxaro) showing strategic intent to diversify its core business into renewable energy production, and three others (Glencore, South32 and Anglo American) implementing some form of renewable energy deployment on-site to reduce energy demands. It was also found that all the companies investigated are engaging with the South African government concerning the design of the carbon tax and budget that is due to be implemented later in 2018. It is apparent that all five companies are concerned with the financial risk that policy will carry, and are attempting to influence its design.

All five companies state their initiatives to improve operational performance and reduce their on-site emissions but make no-mention of the carbon-intensive nature of the product they produce. For example Exxaro emits 0.8 million $MtCO_2e$ through energy use but it indirectly emits 71.6 $MtCO_2e$ through combustion of their sold coal products. Therefore Exxaro may increase their

energy efficiency or employ renewable energy and thus decrease their on-site emissions but it will have minimal impact on the overall national emissions and hence a minimal effect in contributing toward Sustainable Development Goal 13 (Climate Action).

In conclusion it has been found that coal companies operating in the South African coal sector do have the sufficient systems in place to measure and report on critical information for reaching Sustainable Development Goal 7 (Clean Energy) and Sustainable Development Goal 13 (Climate Action), however it cannot be confidently stated that the companies had by 2016 fully reflected in their reports on the core implication of these targets for their operations.

5.2.2. Question 2

Can sustainability reports of individual companies be combined to gauge the sustainability performance of the entire coal-mining sector?

All the annual reports reviewed compared environmental data with those of the previous 4-5 years. This represents mature systems of measuring and reporting, and allows stakeholders to determine the performance of a company in terms of whether it is improving or not. All five companies also reported clearly on energy consumption, energy intensity as well as Scope 1, 2, 3 carbon emissions. While this is useful information that can provide many insights into sustainable performance, it is apparent that the data reported provides only a limited perspective of a company's performance, and does not always indicate if the company is operating sustainably. A stakeholder may not be able to contextualise the data into meaningful understanding of the business operation, nor how it translates into sustainable operation over the long term. While the companies evaluated demonstrated a certain level of required systems, processes and practices in order to measure and report on necessary ESG data, the communication and transparency of this information often fell short. Numbers and information contained within the reports should inform stakeholders of the company's sustainability objectives, as well as how they are implemented within the business model and the company's decision making processes. While apparent that the sophistication of sustainability reporting is improving within the mining industry, the progress is not uniform, with not all companies releasing reports in the similar format, using the same accounting systems, or reporting on the same metrics. This means that the ESG performance of one company cannot be compared with another's even if they are both in the same industry. This complicates an overall measure of sustainability and progress toward meeting the SDGs.

Despite all companies using the GRI framework, and all being in the same industry, they did not all report on the same indicators. This inconsistency is due partly to the difference in the process of defining materiality for each company. Materiality is the process of defining which issues are deemed important and should be measured and reported, and which should be omitted. An item of information is considered "material" if its omission or misstatement were to influence the economic decision made by the reports' user (Faux, 2012). As became evident in the content analysis in section 4.2, there was a lack of consistency in the materiality definition process, despite the companies' analysed being in a common industry. If a company has deemed an indicator to be "not material" in its materiality assessment, then it simply does not report on it. This was the most common reason provided by companies as to why a given indicator had not been reported on. The determination process is largely subjective and is assessed by the governance structure within the organisation. The high degree of subjective judgment creates a scenario in which some

issues that are material but could damage the reputation of the company may not be disclosed under the claim that it is declared non-material. Therefore the current materiality definition process is open to a high a high likelihood of error or potential misconduct.

These discrepancies in materiality make it difficult to determine whether an industry is improving based merely on sustainability reports. While it is possible for publicly released data to be used to measure a company's sustainable performance on a basic level, doing a comparative analysis remains challenging and there are no industry standards to define what are acceptable emissions or energy uses across different industries. Heuristics are not defined for what an acceptable carbon emission level is for mining companies based on ore, type, and size of mining operation.

5.3. Recommendations

It is recommended that companies report on energy consumption and emission data in intensity values as well as in absolute values. As stated in the conclusions, it is difficult to compare results when they are reported in absolute values as companies operations vary in size and produce a range of different products.

As mentioned in the conclusions, not all companies reported on the same metrics despite all being in the same industry and this due to the inconsistency in defining materiality. It is therefore recommended that there be a uniform process for defining materiality, particularly within specific sectors, in order to facilitate comparability. It would be a recommendation to conduct research into the frequency at which companies incorrectly deem material issues non-material and how the materiality process could be more standardised across industries.

The research found that companies place much focus on their scope 1 and 2 greenhouse gas emissions. However, coal based companies are predominantly exposed through their scope 3 emissions, in particular the combustion of their coal product. An interesting research question would be to investigate the extent of a company's responsibility for their products and what exactly constitutes a green company?

It is recommended that there is a development of appropriate research methods that accompany the release of the UN's Sustainable Development Goals. To allow researchers to follow similar methods in determining the progression of meeting the goals and allowing evidence-based research to be produced on the Sustainable Development Goals. While companies release statements and make commitments toward meeting SDGs, there needs to be further research to develop ways in which performance can be monitored against intention.

6. Bibliography

AccountAbility. 2008. AA1000 ACCOUNTABILITY PRINCIPLES STANDARD.

AccountAbility. 2015. Standards. Available: http://www.accountability.org/standards/.

Adams, C. & Narayanan, V. 2007. The "standardization" of sustainability reporting. *Sustainability, Accounting and Accountability.*

Alyson Warhurst. 2001. Corporate Citizenship and Corporate Social Investment: Drivers of Tri-Sector Partnerships. *Journal of Corporate Citizenship.* (1):57-73. Available: http://www.jstor.org/stable/jcorpciti.1.57.

Andreasson, S. 2011. Understanding Corporate Governance Reform in South Africa. *Business & Society.* 50(4):647-673. Available: http://journals.sagepub.com/doi/full/10.1177/0007650309332205.

Anglo American. 2016. Sustainability Report 2016. Available: www.angloamerican.com/investors/annual-reporting/reports-library/report-2016.

Anglo American. 2016. Anglo American Annual Report. Available: http://www.angloamerican.com/~/media/Files/A/Anglo-American-PLC-V2/documents/annual-reporting-2016/downloads/annual-report-2016-interactive-v2.pdf.

Anglo American. 2017. Anglo American Carbon Disclosure Project. *Cdp.* Available: https://www.cdp.net/en/responses?utf8=%E2%9C%93&queries%5Bname%5D=Anglo+American.

Anton Eberhard. 2011. The Future of South African Coal: Market, Investment, and Policy Challenges. Stanford: Program on Energy and Sustainable Development.

Annette Gotz & John Hancox. 2014. South Africa's coalfields — A 2014 perspective. International Journal of Coal Geology. 132.

Ashman, S. & Fine, B. 2012. South Africa: The Meaning of Marikana. Think Africa Press.

Azzone, G., Brophy, M., Noci, G., Welford, R. & Young, W. 1997a. A stakeholders' view of environmental reporting. *Long Range Planning.* 30(5):699-709. Available: https://www.sciencedirect.com/science/article/pii/S0024630197000587.

Azzone, G., Brophy, M., Noci, G., Welford, R. & Young, W. 1997b. A stakeholders' view of environmental reporting. *Long Range Planning.* 30(5):699-709. Available: https://www.sciencedirect.com/science/article/pii/S0024630197000587.

Bill Freund. 2010. The significance of the minerals-energy complex in the light of South African economic historiography. *Transformation: Critical Perspectives on Southern Africa.* 71(1):3-25. Available: http://muse.jhu.edu/journals/transformation/v071/71.freund.html.

BP. 2016. Statistical Review of World Energy. Available: http://www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2016/bp-statistical-review-of-world-energy-2016-full-report.pdf.

Bennett, M., James, P., Klinkers, L., Topfer, K., Lash, J., Kingo, L. & Correa, M.E. 1999. Sustainable Measures : Evaluation and Reporting of Environmental and Social Performance. 1st ed. Sheffield: Routledge.

Burton Jesse & Winkler Harald. 2014. South Africa's planned coal infrastructure expansion: drivers, dynamics and impacts on greenhouse gas emissions. Cape Town: Energy Research Centre.

COM. 2014. Chamber of Mines. Available: www.chamberofmines.org.za/mining-industry/coal.

Cennergi. 2014. *Cennergi turns wind into megawatts with help from Wonderware.* Available: https://www.wonderware.co.za/customer-stories/cennergi-turns-wind-into-megawatts-with-help-from-wonderware-2/[April 2016].

Cowen, S.S., Ferreri, L.B. & Parker, L.D. 1987. The impact of corporate characteristics on social responsibility disclosure: A typology and frequency-based analysis. Accounting, Organizations and Society. 12(2):111-122. Available: http://www.sciencedirect.com/science/article/pii/0361368287900018.

Chamber of Miners of South Africa. 2015. Integrated Annual Review 2015. Johannesburg, South Africa.

Davidson, O. & Winkler, H. 2003. South Africa's Energy Future: Visions, driving factors and sustainable development indicators.

Death, C. 2014. The Green Economy in South Africa: Global Discourses and Local Politics. Politikon: South African Journal of Political Studies. 41(1):1-22. Available: http://gateway.proquest.com/openurl?url_ver=Z39.88-2004&res_dat=xri:bsc:&rft_dat=xri:bsc:rec:iibp:00449380.

Department of Energy. 2016. Integrated Resource Plan Update. Consultation Draft. Pretoria: Department of Energy.

Department of Mineral Resources. 2009. The future of role of the Waterberg Coalfield in South Africa's Coal Industry. Pretoria: .

Diamond, G. & Price, G. 2012. The political economy of corporate governance reform in South Africa. *South African Journal of Business Management.* 43(1):57-67. Available: http://reference.sabinet.co.za/sa_epublication_article/busman_v43_n1_a5.

Eccles, R.G. & Krzus, M.P. 2010. One report.

Eskom. 2016. Eskom Integrated Report. Available: http://www.eskom.co.za/IR2016/Documents/Eskom_integrated_report_2016.pdf.

Eskom. 2017a. Kusile Power Station. Available: http://www.eskom.co.za/Whatweredoing/NewBuild/Pages/Kusile_Power_Station.aspx [3/23/2017].

Eskom. 2017b. Medupi Power Station. Available: http://www.eskom.co.za/Whatweredoing/NewBuild/MedupiPowerStation/Pages/Medupi_Power_Station_Project.aspx[3/23/2017].

Environmental Economic Accounts Compendium. 2016. Pretoria: Statistics South Africa.

Exxaro. 2017. Exxaro Carbon Disclosure Project. *Cdp.* Available: https://www.cdp.net/en/responses?utf8=%E2%9C%93&queries%5Bname%5D=Exxaro.

Exxaro Resources Limited. Integrated Report 2016. Available: www.exxaro.com/ar/2015/Exxaro_2015_Integrated_Report.pdf[May 15, 2017].

Fasan, M. . 2013. Annual Reports, Sustainability Reports and Integrated Reports: Trends in Corporate Disclosure. In Integrated Reporting. Springer, Cham. 41-57. Available: https://link.springer.com/chapter/10.1007/978-3-319-02168-3_3[Dec 6, 2017].

Fine, B. 2012. Assessing South Africa's New Growth Path: Framework for Change? Review of African Political Economy. 39(134):551-568. Available: http://gateway.proquest.com/openurl?url_ver=Z39.88-2004&res_dat=xri:bsc:&rft_dat=xri:bsc:rec:iibp:00428807.

Fine, B. & Rustomjee, Z. 1996. The political economy of South Africa. London: Hurst & Company.

Fine, B., Saraswati, J. & Tavasci, D. 2013. Beyond the Developmental State : Industrial Policy into the 21st Century. London: Pluto Press.

Flower, J. 2014. The International Integrated Reporting Council: A story of failure. *Critical Perspectives on Accounting.* 27:1. Available: https://search.proquest.com/docview/1662002374.

Gray, R., Kouhy, R. & Lavers, S. 1995a. Corporate social and environmental reporting: a review of the literature and a longitudinal study of UK disclosure. Accounting, Auditing & Accountability Journal. 8(2):47-77.

Gray, R., Kouhy, R. & Lavers, S. 1995b. Methodological themes: Constructing a research database of social and environmental reporting by UK companies. Accounting, Auditing & Accountability Journal. 8(2):78. Available: https://search.proquest.com/docview/211289529.

Guthrie, J. & Abeysekera, I. 2006. Content analysis of social, environmental reporting: what is new? Journal of Human Resource Costing & Accounting. 10(2):114-126.

Guthrie, J. & Mathews, M.R. 2007. Corporate social accounting in Australasia. :153-179. Available: http://www.econis.eu/PPNSET?PPN=560483848.

Gibson, R. & Guthrie, J. 1994. The greening of public sector annual reports: towards a benchmark. Public Sector Centre of Excellence.Readings in Accounting Developments in the Public Sector. 95:68-79.

Guthrie, J. 1999. There is No Accounting for Knowledge in the Australian Context.

G. J. Rossouw, A. van der Watt & D. P. Malan. 2002. Corporate Governance in South Africa. *Journal of Business Ethics.* 37(3):289-302. Available: http://www.jstor.org/stable/25074755.

G.J. Rossouw. 2002. Business ethics and corporate governance in the Second King Report: Farsighted or futile? *Koers : Bulletin for Christian Scholarship.* 67(4):405-420. Available: https://doaj.org/article/9bbfbf5d5c6e4903b00c49b996886d61.

Glencore. Sustainability Report 2016. Available: www.glencore.com/assets/sustainability/...reports/2016-Glencore-Sustainabilty-Report.pd... [May 15,2017].

Glencore. 2017. Glencore Carbon Disclosure Project *Cdp.* Available: https://www.cdp.net/en/responses?utf8=%E2%9C%93&queries%5Bname%5D=Glencore.

Glencore. 2016. Annual Report. Available: http://www.glencore.com/assets/investors/doc/reports_and_results/2016/GLEN-2016-Annual-Report.pdf.

Global Reporting Initiative. 2013. The external assurance of sustainability reporting. Research and Development Series.Retrieved May. 1:2014.

Gray, R., Kouhy, R. & Lavers, S. 1995. Corporate social and environmental reporting: A review of the literature and a longitudinal study of UK disclosure. *Accounting, Auditing & Accountability Journal.* 8(2):47. Available: https://search.proquest.com/docview/211240964.

Hamann, R., Agbazue, T., Kapelus, P. & Hein, A. 2005. Universalizing Corporate Social Responsibility? South African Challenges to the International Organization for Standardization's New Social Responsibility Standard. *Business and Society Review.* 110(1):1-19. Available: http://www.ingentaconnect.com/content/bpl/basr/2005/00000110/00000001/art00001.

Hartnady, C.J.H. 2010. South Africa’s diminishing coal reserves. *South African Journal of Science.* 106(9/10) Available: https://doaj.org/article/df5c6c77a41d45eba6ed59409fb6d98f.

Hackston, D. & Milne, M.J. 1996. Some determinants of social and environmental disclosures in New Zealand companies. Accounting, Auditing & Accountability Journal. 9(1):77. Available: https://search.proquest.com/docview/211242239.

Hines, R.D. 1989. Financial accounting knowledge, conceptual framework projects and the social construction of the accounting profession. Accounting, Auditing & Accountability Journal. 2(2).

Hines, R.D. 1989. The sociopolitical paradigm in financial accounting research. Accounting, Auditing & Accountability Journal. 2(1).

Hsieh, H. & Shannon, S.E. 2005. Three Approaches to Qualitative Content Analysis. Qualitative Health Research. 15(9):1277-1288. Available: http://journals.sagepub.com/doi/full/10.1177/1049732305276687.

IIRC. 2011. Towards Integrated Reporting, Communicating value in the 21st Century. Available: www.theiirc.org/wp-content/uploads/ 2011/09/IR-Discussion-Paper-2011_single.pdf.

IIRC. 2014. *IIRC Welcomes South Africa's Endorsement of the International Integrated Reporting Framework.*

INDC. 2015. *South Africa's Intended Nationally Determined Contribution (INDC).* Available: https://www.environment.gov.za/sites/default/files/docs/sanational_determinedcontribution.pdf [Oct 12, 2017].

(IEA) International Energy Agency. 2016. Key Coal Trends. International Energy Agency.

IOD. 2009. *The King Code of Governance for South Africa (2009) and King Report on Governance for South Africa.* Johannesburg,South Africa: .

ISO. 2015. *Standards: ISO 26000 - Social Responsibility.*

King, M. 2012. Comments on: Integrated Reporting and the Integrated Report. *International Corporate Governance Conference.* 23 October 2012. Johannesburg,South Africa: .

KPMG. 2012. An Update on Trends in Voluntary and Mandatory Approaches to Sustainability Reporting. Available: https://www.globalreporting.org/resourcelibrary/Carro ts-And-Sticks-Promoting-Transparency-And- Sustainbability.pdf.

KPMG. 2013. *KPMG Survey of Corporate Responsibility Reporting.* Amsterdam: .

Krippendorff, K. 2004. Content analysis: An introduction to its methodology. Sage.

Kwagga, M. 2013. South Africa's green economy transition: implications for reorienting the economy towards a low-carbon growth trajectory.

Leiman, T. 2010. Can the climate change bandwagon's piccolo player start conducting?Taking action on climate change : Long-term mitigation scenarios for South Africa, Harald Winkler : book review. South African Journal of Science. 106(11 & 12):1. Available: http://reference.sabinet.co.za/sa_epublication_article/sajsci_v106_n11_12_a8.

Macdonald, D. 2015. *Eskom must pay for Arnot shutdown - Exxaro.* Available: https://www.fin24.com/Companies/Mining/eskom-must-pay-for-arnot-shutdown-exxaro-20151202 [January 2016].

Mapping mining to the sustainable development goals: An atlas. 2016.

Mallin, C.A. 2006. *International corporate governance.* Cheltenham [u.a.]: Elgar.

Marquard Andrew. 2006. *The Origins and Development of South African Energy Policy.* University of Cape Town.

Mckay, D. 2017. *South32 begins process to spin-off South African coal business.* Available: http://www.miningmx.com/news/energy/31063-south32-begins-process-spin-off-south-african-coal-business/[December 15, 2017].

Mining Review Africa. 2016. *Exxaro's Thabametsi power project chosen as preferred IPP bidder.* Available: https://www.miningreview.com/news/exxaros-thabametsi-power-project-preferred-ipp-bidder/ [April 2017].

MMSD. 2002. *Breaking new ground [electronic resource] : the report of the Mining, Minerals and Sustainable Development Project.* London: .

Molwatt, G. 2013. *10 pretty cool inventions you may not have known come from South Africa.* Available: https://www.thesouthafrican.com/the-top-10-south-african-inventions/ [Jan 4, 2018].

Montmasson-clair, G. Mining value chains and green growth in South Africa:A conflictual but intertwined relationship. Trade and International Policy Strategies.

Neu, D., Warsame, H. & Pedwell, K. 1998a. Managing public impressions: environmental disclosures in annual reports. *Accounting, Organizations and Society.* 23(3):265-282. Available: http://econpapers.repec.org/article/eeeaosoci/v_3a23_3ay_3a1998_3ai_3a3_3ap_3a265-282.htm.

Neu, D., Warsame, H. & Pedwell, K. 1998b. Managing public impressions: environmental disclosures in annual reports. *Accounting, Organizations and Society.* 23(3):265-282. Available: http://econpapers.repec.org/article/eeeaosoci/v_3a23_3ay_3a1998_3ai_3a3_3ap_3a265-282.htm.

Nhamo, G. 2014. Breakthrough:Corporate South Africa in a green economy. Pretoria: Africa Institute of South Africa.

Nicole Dando & Tracey Swift. 2003. Transparency and Assurance: Minding the Credibility Gap. *Journal of Business Ethics.* 44(2/3):195-200. Available: http://www.jstor.org/stable/25075028.

Nilsson, M., Griggs, D., Visbeck, M., Ringler, C. & McCollum, D. 2017. A FRAMEWORK FOR UNDERSTANDING SUSTAINABLE DEVELOPMENT GOAL INTERACTIONS.

Patten, D.M. 1991. Exposure, legitimacy, and social disclosure. Journal of Accounting and Public Policy. 10(4):297-308. Available: http://www.sciencedirect.com/science/article/pii/0278425491900033.

Patten, D.M. 1992. Intra-industry environmental disclosures in response to the Alaskan oil spill: A note on legitimacy theory. Accounting, Organizations and Society. 17(5):471-475. Available: http://www.sciencedirect.com/science/article/pii/036136829290042Q.

Parker, L.D. 2005. Social and environmental accountability research: A view from the commentary box. Accounting, Auditing & Accountability Journal. 18(6):842-860.

Pearce, D.W. & Atkinson, G.D. 2009. Capital theory and the measurement of sustainable development. Sustainability. :397-402. Available: http://www.econis.eu/PPNSET?PPN=618736816.

Pearce, D.W., Markandya, A. & Barbier, E. 1989. Blueprint for a green economy. 1. publ. ed. London: Earthscan Publ.

Peck, P. & Sinding, K. 2003. Environmental and social disclosure and data richness in the mining industry. *Business Strategy and the Environment.* 12(3):131-146. Available: http://onlinelibrary.wiley.com/doi/10.1002/bse.358/abstract.

Prevost Xavier. 2015. Coal in the Global and South African Context. Available: http://www.fossilfuel.co.za/conferences/2015/JCMV-X/Session-1/02Xavier-Prevost.pdf [3/24/2017].

PWC. 2016. SA Mine 8th edition. Available: http://www.pwc.co.za/en/publications/sa-mine.html

RBCT (Richards Bay Coal Terminal). 2016. Richards Bay Coal Terminal. Available: https://www.rbct.co.za/ [3/14/2017].

Rea, M. 2012. Review of Sustainability Reporting in South Africa as per the Global Reporting Initiative (GRI) Guidelines. IRAS.

Ryan Brendan. 2014. Coal reserves study gives lie to Eskom supply scare. Business Day 17 Apr. Available: http://www.pressreader.com/south-africa/business-day/20140417/281487864337610 [3/16/2017].

R. H. Cassen. 1987. Our Common Future: Report of the World Commission on Environment and Development. Available: http://www.jstor.org/stable/2621529 .

Rikhardsson, P., Raj Andersen, A.J. & Bang, H. 2002. Sustainability Reporting on the Internet. *Greener Management International.* 2002(40):57-75.

Riseborough, J. 2017. Glencore Doubles Down on Coal as Mining Rivals Seek to Exit (1). *Las Cruces Sun - News* Jun 13,. Available: https://search.proquest.com/docview/1908898094 .

Salterbaxter. 2003. *Trends in CSR reporting 2002-2003.* London.

Sasol. Annual Integrated report. Available: www.sasol.com/investor-centre/financial-reporting/annual-integrated-reporting-set [May 15, 2017].

SACRM (South African Coal Roadmap Steering commitee). 2013. The South African Coal Roadmap.

Sasol. 2016. Integrated Report. Available: http://www.sasol.com/extras/AIR_2016/sites/air_2016/files/Annual%20Integrated%20Report%202016_0.pdf.

Sasol. 2017. Sasol Carbon Disclosure Project. Cdp. Available: https://www.cdp.net/en/responses?utf8=%E2%9C%93&queries%5Bname%5D=Sasol.

Savannah Environmental. 2016. Climate Change Impact Assessment Report for Thabametsi IPP Coal-Fired Power Station.

South32. Annual Report. Available: https://www.south32.net/CMSPages/GetFile.aspx?guid=805af58e-03f7-401f-94c3...[May 18, 2017]

Statistics South Africa. 2016. Environmental Economic accounts Compendium. Pretoria: Statistics South Africa.

Scott, K., Park, J. & Cocklin, C. 2000. From `sustainable rural communities' to `social sustainability': giving voice to diversity in Mangakahia Valley, New Zealand. *Journal of Rural Studies.* 16(4):433-446. Available: https://www.sciencedirect.com/science/article/pii/S0743016700000188.

Solomon, J. & Maroun, W. 2012. *Integrated reporting: the new face of social, ethical and environmental reporting in South Africa?* .

South32. 2017. South32 Carbon Disclosure Report *Cdp.* Available: https://www.cdp.net/en/responses?utf8=%E2%9C%93&queries%5Bname%5D=South32.

The Paris Climate Agreement.2015. Available: https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf [January 2016].

Thabametsi Court Hearing – Earthlife Africa Available: http://earthlife.org.za/2017/03/thabametsi-court-hearing-newsflash-mr/ [Mar 23, 2017].

Trotman, K.T. & Bradley, G.W. 1981. Associations between social responsibility disclosure and characteristics of companies. Accounting, Organizations and Society. 6(4):355-362. Available: http://www.sciencedirect.com/science/article/pii/0361368281900143.

UNEP, KPMG, GRI & Unit for Corporate Governance in Africa. 2013. Sustainability reporting policies worldwide - today's best practice, tomorrow's trends. Available: https://www.globalreporting.org/resourcelibrary/Carrots-And-Sticks-Promoting-Transparency-And-Sustainbability.pdf.

USAID. 2016. *Greenhouse Gas Emissions in South Africa.*

UNGC. 2018. *United Nations Global Compact.* Available: https://www.unglobalcompact.org/what-is-gc/mission [Jan 2, 2018].

United Nations. Department of Economic. 2007. Indicators of sustainable development: Guidelines and methodologies. United Nations Publications.

Vaughn, M. & Ryan, L.V. 2006. Corporate Governance in South Africa: a bellwether for the continent? *Corporate Governance: An International Review.* 14(5):504-512. Available: http://onlinelibrary.wiley.com/doi/10.1111/j.1467-8683.2006.00533.x/abstract.

Winkler, H. 2007. Energy policies for sustainable development in South Africa. Energy for Sustainable Development. 11(1):26-34. Available: http://www.sciencedirect.com/science/article/pii/S097308260860561X.

WINKLER, H. & MARQUAND, A. 2009. Changing development paths: From an energy-intensive to low-carbon economy in South Africa. Climate and Development. 1(1):47-65. Available: http://www.tandfonline.com/doi/abs/10.3763/cdev.2009.0003.

World Economic Forum. 2016. Mapping Mining to the Sustainable Development Goals: An Atlas.

World Resources Institute. 2014. Climate Analysis Indicators Tool Version 2.0.

Yeld, J. 2011. *Fall in line on climate change, Sasol told.* Available: https://www.iol.co.za/news/fall-in-line-on-climate-change-sasol-told-1176349 [12 March, 2016].

7. Appendices

7.1. Definitions of the indicators used

Indicator definitions are provided for those that are not self-evident.

Total Direct Energy Consumption (Gigajoules, GJ) – i.e., from fuels burned

All energy consumed for any purpose, including electricity generated by the organisation, but excludes any electricity sold by a third party (i.e., Eskom-supplied electricity). By 'direct', one can assume that the fuel is burned by the reporting entity, including petrol, diesel, coal, anthracite, liquid petroleum gas (LPG), liquefied natural gas (LNG), paraffin, wood, other biomass, etc. The standard unit of measurement is Gigajoules (GJ), or millions of Joules, where the joule is the standard unit of energy, regardless of whether or not the fuel burned is used to generate electricity, which would be measured in kilowatt hours (kWh).

Total Indirect Energy Consumption (Gigajoules, GJ)

Total indirect energy – electricity, heat or steam – purchased from third-parties during the reporting period, including all electricity purchased from any source/supplier including independent power producers (IPPs), and excluding any electricity generated by the operation itself. The unit of measurement is Gigajoules (GJ), or millions of Joules, as it provides a comparison to the amount of Total Direct Energy consumed.

Total Energy Intensity (Megawatt hours, MWh)

Electricity purchased from third-parties (i.e., Eskom) during the reporting period, including all electricity purchased from alternative sources/suppliers including independent power producers (IPPs) generating electricity from wind and/or solar, and excluding any electricity generated by the operation itself. The unit of measurement is Megawatt hours (MWh).

Target Reduction in Energy/Electricity Intensity
Energy intensity ratio includes energy consumption divided by a denominator chosen by the organistion to set its target. Denominators include Revenue, Person worked hours or the mass or units of products produced.

$$Target\ Reduction\ in\ Energy\ Intensity = \frac{Energy\ consumption}{Denominator\ of\ choice}$$

Reductions in Energy requirements of products and services

Report the reductions in the energy requirements of sold products and services achieved during the reporting period, in joules or multiples. Report the basis for calculating reductions in energy

consumption such as base year or baseline, and the rationale for choosing it. This Indicator follows the methodology of GRI Indicator G4-EN7.

Total Carbon Emissions (Tons of Carbon Dioxide equivalents, CO2e)

The breakdown of direct and indirect carbon emissions is restricted to three broad scopes:

- Scope 1: All direct GHG emissions resulting from the burning of fossil fuels.
- Scope 2: All indirect GHG emissions resulting from the consumption of purchased electricity, heat or steam, where fossil fuels would have been burned at the source of the energy purchased. Total electricity purchased converted to tonnes CO2 e Electricity-based emissions are derived from the grid emissions factor for South Africa (0,94t CO2e/MWh)
- Scope 3: All other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity – including air travel – electricity-related activities not covered in Scope 2, outsourced activities, waste disposal etc.

Carbon emissions Intensity

GHG intensity targets contrast with absolute targets, which limit total emissions. Absolute targets are expressed simply as a fixed number of tons of CO2 equivalent, to be achieved at some point in the future (usually expressed as a change relative to a base year that has a known quantity). While intensity targets seek to achieve a particular emission rate. There can be various emission rates set.

$$CO_2\ emission\ intensity = \frac{CO_2\ emissions}{Person\ hours\ worked}$$

$$CO_2\ emission\ intensity = \frac{CO_2\ emissions}{Revenue}$$

$$CO_2\ emission\ intensity = \frac{CO_2\ emissions}{Products\ Produced}$$

Target Reduction in GHG emissions
The company must either state an absolute or intensity target. If a company states an absolute target it receives a score of 1 and if it states an intensity value it receives a score of 2.

Climate change integrated into Business strategy
Company must present examples of how climate change is factored into the business strategy of the company.

Risks and opportunities posed by climate change that have the potential to generate substantive changes in operations, revenue or expenditure
The company must present the risks and opportunities that are posed to the firm from climate change or climate change related legislation.

Participation in emission-trading schemes

Indicator stating the participation in certified emission trading schemes

Expenditure on treatment of emissions
Company quotes total monetary expenditure on the treatment of emissions.

Highest level of direct responsibility for climate change within the organisation

Percentage of total operation spend on low carbon products/technologies
The company must state a range or spend on products that are qualified as low carbon or green.

7.2. PHW Calculation

PHW calculated, on the following basis:

$$PHW\ per = \ (\{([Weeks\ in\ year - weeks\ of\ leave] \times days\ in\ a\ week) - public\ holidays\} \times hours\ in\ a\ work\ day) \ \times number\ of\ employees$$

$$PHW = (\{[(52 - 4) \times 5] - 12\} \ \times 8) \ \times number\ of\ employees$$

$$PHW = 1824\ hours \times number\ of\ employees$$